

Emergency Health Services Demand & Service Delivery Models



Monograph 1
Literature Review & Activity Trends

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Emergency Health Services: Demand & Service Delivery Models

Monograph 1

Literature Review & Activity Trends

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Acronyms

A&EDs	Accident and Emergency Departments
ABS	Australian Bureau of Statistics
ACEM	Australasian College for Emergency Medicine
ACEN	Australian College of Emergency Nursing
ACT	Australian Capital Territory
AED	Accident & Emergency Department
AIHW	Australian Institute of Health and Welfare
AIPC	Australian Institute for Primary Care
ARC	Australian Research Council
ATS	Australasian Triage Scale
CAA	Council of Ambulance Authorities
CAC	Community Ambulance Cover
CENA	College of Emergency Nursing Australasia
CSCF	Clinical Services Capability Framework
DoHA	Department of Health and Ageing
ED	Emergency Department
EHS	Emergency Health Services
EHSQ	Emergency Health Services Queensland Study
EMS	Emergency Medical System
FACEM	Fellow of Australasian College for Emergency Medicine
FTE	Full-time Equivalent
GP	General Practitioner
HBM	Health Belief Model
HIH	Hospital in the Home
HiNH	Hospital in the Nursing Home
HSUM	Health Services Utilisation Model
NHS	National Health Survey
NSW	New South Wales
NT	Northern Territory
OHS	Overcrowding Hazard Scale
OTC	Over the Counter
QAS	Queensland Ambulance Services
QEMS	Queensland Emergency Medical System
QH	Queensland Health
Qld	Queensland
RFDS	Royal Flying Doctor Service
SA	South Australia
SCT	Social Cognitive Theory
Tas	Tasmania
TPB	Theory of Planned Behaviour
TRA	Theory of Planned Action
UHU	Unit Hour Utilisation
Vic	Victoria
WA	Western Australia

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Executive Summary

Introduction

The term 'Emergency Health Services' (EHS) encompasses hospital Emergency Departments (ED), ambulance services and a range of aero-medical, retrieval, and transfer services that provide integrated medical care to people suffering acute illness and injury. EHS is a significant and high profile component of Australia's health care system and congestion of these, evidenced by physical overcrowding and prolonged waiting times, is causing considerable community and professional concern. This concern relates not only to Australia's capacity to manage daily health emergencies but also the ability to respond to major incidents and disasters.

EHS congestion is a result of the combined effects of increased demand for emergency care, increased complexity of acute health care, and blocked access to ongoing care (e.g. inpatient beds). Despite this conceptual understanding there is a lack of robust evidence to explain the factors driving increased demand, or how demand contributes to congestion, and therefore public policy responses have relied upon limited or unsound information.

The Research Program

The Emergency Health Services Queensland (EHSQ) research program proposes to determine the factors influencing the growing demand for emergency health care and to establish options for alternative service provision that may safely meet patient's needs. The EHSQ study is funded by the Australian Research Council (ARC) through its Linkage Program and is supported financially by the Queensland Ambulance Service (QAS).

The specific objectives of this research program are the:

1. identification, analysis, and evaluation of the factors that influence demand for EHS;
2. identification of drivers for EHS demand;
3. identification of the pattern and scope of services currently provided in Australia;
4. development of predictive models of future EHS demand;
5. identification and evaluation of possible alternative models of service delivery that could satisfactorily meet patient need;
6. provision of evidence on which to base future policy development, as well as design and development of new EHS systems and structures.

This research program comprises four sub-studies:

Study 1: Examination of the literature, and current operational context, to develop a conceptual understanding of the factors influencing growth in demand so as to identify demand trends.

Study 2: Examination of data privately held by both the Queensland Ambulance Service and the Queensland Health Emergency Departments on patient trends, to determine the characteristics of users.

Study 3: Structured interviews with patients to identify quantitatively and qualitatively the factors that they take into consideration in seeking acute medical assistance.

Study 4: Analysis and synthesis of all data to provide a structured predictive model of demand and of the policy options for demand management, in consultation with EHS stakeholders.

This first monograph presents the outcomes of Study 1. Literature was sourced using standard search approaches and a range of databases as well as a selection of articles cited in the reviewed literature. Public sources including the Australian Institute of Health and Welfare (AIHW), the Council of Ambulance Authorities (CAA) Annual Reports, Australian Bureau of Statistics (ABS) and Department of Health and Ageing (DoHA) were examined for trend data across Australia.

Theoretical Framework for the Study of EHS Demand

For the purposes of the current research program, demand for EHS at the individual level is considered a health-seeking behaviour that can be explained by **socio-demographic factors** which are mediated and modified through the **individual's health beliefs and perceptions, personal characteristics, social environment, and illness conditions**. Using theoretical models such as the Health Belief Model, Health Services Utilisation Behaviour, Theory of Planned Behaviour, Decision Making Theory, and Social Support and Social Networks Theory, a conceptual framework has been developed to aid understanding of the relationships between the various factors influencing demand as identified in the literature.

The immediate factors that can affect an individual's decision to seek healthcare are their own perception of the severity, complexity and acuity of the illness, as well as their general health status. The decision to pursue a particular course of action is influenced by an analysis of the associated costs and benefits. Therefore if a condition is considered to be worthy of medical attention, the benefits and barriers of the action (e.g. seeing a GP or visiting an ED instead) are consequently considered. Benefits and barriers are likely to include financial factors, convenience, and (perceived or actual) access to and availability of the health services.

The decision to choose a particular action is a reflection and/or effect of one's beliefs regarding the health system; learnt norms and values about how to act at times of sickness; personality traits such as self-efficacy and belief in one's abilities; previous experience and information such as having a family member who received good treatment at ED; and environmental factors such as peer pressure and support networks. The influence of these factors becomes more evident when patients, with lower acuity problems, seek emergency medical care as a result of a decision by a bystander, or because of a perception that using an ambulance would give them a higher priority and they would be able to 'jump the queue'.

Finally, socio-demographic characteristics can determine or alter how people feel, think, learn and behave in a perceived emergency or when deciding to attend an ED. For example an elderly person living alone and without access to a car or other forms of transport is more likely to call an ambulance. Or, a newly arrived migrant or refugee without a clear and detailed knowledge of the host country's medical system may act the way they did in their previous country. The relationships among these factors are not necessarily linear and one-way (cause-effect) and in many situations new experiences can change old perceptions and lead to a change of behaviour in the future.

Key Findings

Rising Demand for EHS

In 2009-10, Australian public hospital EDs reported nearly 7.4 million occasions of service across the country, equal to 331 services per 1000 population. Utilisation rates ranged from 286 per 1000 in Victoria to 577 per 1000 in the Northern Territory. Queensland was above the national average with 350 per 1000 occasions of service. The per capita demand for EDs grew at an annual rate of 2% in Australia in the period between 1998-99 and 2009-10. Growth varied between the states and territories; the Northern Territory (0.5%), South Australia (0.8%), and Queensland (0.8%) had the lowest annual growth rates while Tasmania had the highest (7.4%) during this period.

In 2009-10, over 3 million ambulance incidents were recorded across Australia, equal to 137 per 1000 population. Rates ranged from 89 per 1000 in Western Australia to 169 per 1000 in Queensland. Per capita demand for ambulance services rose at an average annual rate of 3.7% in the period between 1999-00 to 2009-10. Western Australia (2.1%) recorded the slowest annual growth in ambulance utilisation rates and Tasmania (6%) the highest.

Factors Affecting ED Demand

Factors driving demand for EDs can be grouped broadly into three categories: individual factors; societal factors; and health system factors.

Individual Factors include patient characteristics that are known to affect health service utilisation, such as demographics (age, gender, living arrangements), socio-economic status, health insurance status, health and well-being profile, and health literacy.

The elderly appear to be consistently higher users of ED than most other age groups. However, study results on ED use in younger age groups differ by country and system. Other factors such as socio-economic status, ethnic or indigenous background, and living in deprived areas can increase the rate of ED visits.

Demand for ED care is also associated with actual and/or perceived presence of an illness/injury. Studies that focus on medical criteria argue that high acuity patients are "appropriate" users and should be treated in the ED, while the low acuity group are more appropriately managed as primary care patients. However, studies conducted on patient decision making suggest that it is the patient's perception of the seriousness of their illness

which determines where they seek care. In this respect, higher levels of health literacy and possibly increased awareness of health services are also likely to drive demand.

Frequent users have also been blamed for increasing the ED load. However, frequent users are also likely to be “sicker” than infrequent users and likely to use ED intensely within a short period and not at all at other times.

Health System Factors, the way services are organised and funded, also drive demand for EDs. However, much less is known about how these factors impact on ED workloads. Factors such as a hospital’s location, type and size, as well as access to affordable alternative services (e.g. bulk-billing GPs) may have an impact. This latter factor has been the subject of much policy attention but the relationship is still very unclear.

Lack of appropriate care for chronic disease in other health settings such as nursing homes may impact on the magnitude of demand for ED care. Some studies have demonstrated that increased access to primary health care services, including general practice and community clinics, reduces demand for ED but others have shown no effect. Many people consider the ED more appropriate as a source of better quality of care and convenience.

Health insurance status has been associated with increased ED use in the United States but the same relationship may not be true for Australia because of the differences in our funding of public health systems. Reduced affordability of alternate health care services however has been related to the rise in demand for emergency department services in the lower acuity spectrum.

Societal Factors have been shown to impact ED demand because of the population’s expectations for equitable and affordable access to specialised health services. However, little evidence exists as to the extent of the impact of these factors. The ageing of the population and the associated increases in chronic disease may prove to be a significant contributor to demand for ED. In Australia, patients aged 65 and over comprised 17.7% of ED presentation in 2007-08 while they form 13.1% of the total population.

Other social phenomena which may have some bearing on utilisation patterns are peer pressure and health related anxiety which occur in some population sub-groups. Additionally, living arrangements affect ED use, particularly for people isolated from social support.

Factors Affecting Ambulance Demand

Reports published to date which examine the drivers of demand for ambulance have generally relied on demographic factors to explain demand increase, although several reports have also speculated about other potential factors such as funding models, limited access to primary healthcare, and the burden of chronic disease.

Both demographic and illness related factors (e.g. perceived threat of illness) are significantly associated with demand for ambulance. Population growth and ageing has been estimated to account for about 20% of demand for ambulance in Queensland and 17% in England. An Australian study found that arrival by ambulance to the ED was 2.9 times

higher among patients aged over 65 years. The impact of ethnicity, gender, and time of day are not well known.

International comparisons are further challenged by the variety of funding arrangements and the different skill sets of staff. The impact of price is unclear although often publicly cited as a significant impact factor. Ambulance services may incur no cost to individuals because services are government funded, or they may incur a significant cost to the patient which may or may not be offset by insurance arrangements.

Other population related factors that may place extra pressure on ambulance demand include residents in geographically deprived areas, binge drinkers and those involved in substance abuse, and bystanders to minor car accidents, however the impact of these factors has not been quantified. Similarly the impacts of patient decision making and increasing health literacy have not been canvassed in regard to pre-hospital care.

The operational context may also impact on ambulance demand. Symptoms of system congestion such as prolonged waiting times, ramping, or bypass arrangements may affect the capacity of emergency pre-hospital services to respond to demand in the community. However evidence of the impact of these circumstances for ambulance response has not to date been rigorously examined.

EHS Demand Management

Debate has arisen over the last decade surrounding appropriate and necessary versus inappropriate and unnecessary EHS utilisation. The findings of these studies with regard to their impact on demand pressures are questionable since they often depend on post-hoc validation of the patient's symptoms by medical staff. These studies estimate the proportion of inappropriate or unnecessary ED utilisation at 11% to 50%. Rarely do these studies take into account the patients' reasons for seeking assistance or the paramedics' decision to transport the patient.

Articulating the drivers of demand for Emergency Health Services is a relatively new endeavour. The analysis of this phenomenon will be multifaceted and may present many challenges to established and traditional positions regarding roles and responsibilities of the agencies providing services. Regardless of these challenges, finite public health care resources require cost effective solutions to manage increasing demand. Demand management in the broader health care system, over the last two decades in particular, has engaged policy makers, researchers and other stakeholders in forecasting, planning and policy development; to identify and test new models for health service delivery. This same multidisciplinary approach is required at the entry point to emergency health care.

Over the last decade, nationally and internationally, several interventions aimed at reducing demand for Emergency Health Services have been tested. These include expanding the role of primary health care, expanded decision making roles for paramedics, telephone health advice, public education campaigns, patient education and communication, strategies to reduce re-admissions, patient co-payments, and initiatives such as Hospital in the Nursing Home (HINH) and Hospital in the Home (HIH)

programmes. The short- and long-term effectiveness of these interventions in reducing demand varies and is contested.

Conclusions

It is generally accepted that health system congestion arises from several factors; deficiencies in patient flow, limitations to service availability, inappropriate policy development, and the inefficient coordination of services to address growth in demand. Therefore, identifying the factors that affect demand is of significance in developing policies and strategies, to reduce congestion, that do not adversely affect patient outcomes or patient safety. The effects of the strategies applied to date have been mixed. For instance, telephone advisory services have not been shown to reduce demand, whereas programs such as Hospital in the Home and self management of chronic disease seem to reduce EHS demand without threatening the safety of the patients.

It is important to ensure that these initiatives which aim to facilitate reduction in congestion or demand are directed at the real reasons underlying the problem and are supported by evidence. The EHSQ aims to analyse these issues in detail and to propose solutions appropriate for the Australian EHS environment.

1. Introduction

Overview

While Emergency Health, particularly trauma, has always been a principal focus of health care, it has only been in the last century that a more organised approach to Emergency Health Service (EHS) provision has occurred; the majority of these developments have been in the last thirty years.

EHS evolved rapidly following the recognition of Emergency Medicine as a medical specialty, and the development of other new health professions such as Paramedics, and Emergency and Critical Care Nursing. In Australia, this evolution featured modernisation and upgrading of ambulance services, reformation of Casualty Departments into modern Emergency Departments (EDs), and the implementation of heightened standards of clinical care throughout the system; at times Australia has led similar developments internationally.

EHS describes the range of personnel and facilities that, together, provide for the care of acutely ill and injured people. These services include first aid, primary care, pre-hospital care, emergency medicine, transport and retrieval medicine, and aero-medical care. There are differences in this terminology around the world. In North America the term Emergency Medical System (EMS) is used sometimes to describe the whole system and at other times to describe the pre-hospital element. The term EMS is used in other countries to describe the ambulance service only.

The positive impact of EHS specialisation on health outcomes is unquestioned by experts in the area. However, despite this positive impact and considerable investments in personnel and structures, EHS are still the focus of frequently negative political and media attention. Particular emphasis has been placed on the congestion of hospital EDs, the capacity of ambulance services to meet performance standards, and system failures associated with adverse patient outcomes. These pressures on the system, particularly congestion, create considerable patient and staff distress and have also been shown to have an adverse impact on health outcomes [1-4].

Adjustments to public policy in response to these issues frequently lack a sound evidence base, are politically reflexive, and have often been founded on incomplete understanding of the issues. Many of the solutions have failed to address the fundamental causes and have been ineffective and/or unsustainable. Strategic investment in General Practitioner (GP) super-clinics and telephone health advice (e.g. 13HEALTH) provides limited evidence or support for these services' effectiveness in reducing demand for either ambulance or emergency departments [5, 6].

Appropriate policy, that seeks to reduce the impact of the growing demand for EHS, while maintaining safe and high quality care for those in need, should be based on a detailed understanding of the factors influencing demand, and the clinical, and other service needs, of the patient.

The Emergency Health Services Queensland Study (EHSQ)

The EHSQ is a program of studies funded by the Australian Research Council (ARC) Linkage Grant and the Queensland Ambulance Service (QAS). The intent of this program is to identify the underlying patterns and causes of the growth in demand for Emergency Health Services and provide evidence for designing and evaluating options to meet that demand in a more appropriate manner in the future.

The specific objectives of the EHSQ Study include:

1. To analyse and evaluate the factors that influence demand for EHS;
2. To identify the pattern and scope of services provided;
3. To identify the needs for EHS and to develop predictive models of demand; and
4. To identify and evaluate alternative models of service delivery that will satisfactorily meet patients' needs.

The program of research derives data from publically available sources as well as three primary sources, these are:

1. De-identified data of ambulance and ED users in Queensland;
2. Focus groups and a survey of ambulance and ED users; and
3. Focus groups and a survey of staff involved in service delivery.

This study seeks to identify the issues contributing to the increasing demand for EHS and to convert that information into policy proposals that can lead to improved service delivery recommendations. Identification and addressing of the issues underlying this demand will have a highly beneficial impact on the community's satisfaction with Emergency Health Services. This program will provide an evidence base for future policy development and the design and development of new EHS, or modifications to existing systems.

Emergency Health contributes to the national research priority of promoting and maintaining good health. Improvements in EHS are critical to improvements in patients' access to the health care system. This study will strengthen Queensland's and Australia's social and economic structure by addressing issues of considerable concern to the community and identifying ways in which Emergency Health provision may be improved to enhance access, capacity, and sustainability of services in the public realm.

This monograph is the first of a series to be derived from the Emergency Health Services Queensland Study. It provides a critical analysis of national and international literature, and a comprehensive analysis of publicly available utilisation data from around Australia. The monograph examines the nature and causes of system congestion – in particular demand for services; crafts a theoretical framework for understanding the issues identified in the literature; discusses methodological issues in research in this field; examines solutions and alternatives proposed; and identifies the actual trends in published data. This will set the ground for succeeding monographs which will focus on EHS user profiles based

on data obtained from Queensland Health and QAS; patients' views and characteristics obtained through analysis of surveys conducted in selected Queensland EDs; policy recommendations; and discussion of the future directions.

2. Context

The Australian Health Care System

The Australian Health Care System is based on a complex inter-relationship between public and private health care sectors, underpinned financially by a compulsory national health insurance scheme (Medicare), a national pharmaceutical subsidy scheme (Pharmaceutical Benefits Scheme) and government subsidised voluntary private hospital insurance. Australia spent an estimated \$112.8 billion on health in 2008-09. This represents 9% of Gross Domestic Product [7: 7, 8]. The public system is directed and funded nationally but is serviced by State and Territory governments and is interfaced with the private health care sector.

History of Emergency Health Services

Emergency Health Services are a key component of the health care system and Emergency Health has been a defining driver for health care advancements. Advances in Emergency Health care have initially arisen as the result of conflict or disaster management. It is generally accepted that systematic approaches to EHS have their primary origins in the military where the sudden imposition of large numbers of casualties requires an organised and systemic approach. Adoption of these principles into the civilian community occurred with the establishment of civilian ambulance services in the late 19th Century. However, these services often lacked the systemic coordination of their military predecessors, either operationally or with regards to policy development.

In Australia, professional ambulance services developed from individuals with military backgrounds or the St John Ambulance service. The role of ambulance officers was largely restricted to providing first aid and transportation until the 1970s when, following similar development overseas, improved clinical care extended the role of the ambulance officer to professional pre-hospital health care. These expansions resulted in the emergence of the paramedic profession and ultimately the introduction of university based educational programs.

Throughout the 1980s and 1990s, Hospital Casualty Departments in Australia were transformed into Emergency Departments (EDs). The new medical specialty of Emergency Medicine followed the creation of the Australasian College for Emergency Medicine (ACEM) in 1983 [9]. Upgraded clinical care within the ED shifted the focus of acute care leading to the ED becoming the site of increasingly complex assessment and management of patients arriving at the hospital. At the same time GPs progressively withdrew from after-hours service provision and house call arrangements.

These complex, and relatively recent, changes to the provision of EHS have resulted in a system which can often be viewed as in distress and overwhelmed by the constant and acute demand placed upon it.

In addition to these demands, Australia's large geography and dispersed populations require aero medical transport as an essential component of the EHS. Fixed wing aero-medical services began in 1928 with the formation of the Royal Flying Doctor Service (RFDS) at Cloncurry, Queensland, by the Reverend John Flynn [10] and have since expanded throughout Australia. These services are now organised within each State and Territory either by the RFDS or other contracted service providers. Hospital based medical retrieval services developed during the 1980s, often in association with new helicopter rescue services, and are now present in all of the densely populated areas of the country. The majority of these developments occurred through individual initiative in response to an existing need rather than coordinated policy.

In comparison to this ad-hoc response are examples of strategic policy development. In the US, for example, a more coordinated approach to policy development began in the 1960s following the publication of the landmark article "Accidental death and disability: the neglected disease of modern society" [11]. This seminal paper led to the introduction of national Emergency Medical System (EMS) legislation, the establishment of EMS services, and the promotion of injury prevention strategies throughout the United States. This strategic approach has also been followed in other countries, particularly in relation to trauma care; and in Queensland through the Queensland Emergency Medical System (QEMS) policy framework and the Queensland Trauma Plan [12, 13] which sought to develop EHS through the construction of policy frameworks.

Emergency Health Services' Organisation in Australia

The 2004-2005 National Health Survey (NHS) identified that an estimated 18% of the Australian population reported suffering an injury in the preceding four weeks [14]. It is acknowledged that not all these patients attend a health service for medical care; some will treat themselves, others will seek first aid from family, friends, neighbours, first aid organisations, or from other professional sources such as pharmacists. However, a significant percentage of these people will seek professional medical assistance from either primary health services such as General Practitioners or from specialised Emergency Health Services. Specialised EHS in Australia are provided principally by ambulance, aero medical services, and public and private hospital based Emergency Departments.

Emergency Departments

Emergency Departments are operational units within hospitals which provide emergency reception, clinical evaluation, and intervention for patients suffering from acute health crises. Emergency Medicine is defined by ACEM as:

"The field of practice based on the knowledge and skills required for the prevention, diagnosis and management of acute and urgent aspects of illness and injury affecting patients of all age groups with a full spectrum of undifferentiated physical and behavioural disorders. It further encompasses an understanding of the development of prehospital and in-hospital emergency medical systems and skills necessary for this development" [15: 337].

The development of specialist training programs in Emergency Medicine by ACEM and the recognition of Emergency Medicine as a medical specialty has seen a rapid expansion in the number and seniority of medical staff in EDs. At the same time emergency nursing programs in a number of universities have emerged, and two professional bodies, the College of Emergency Nursing Australasia (CENA) and the Australian College of Emergency Nursing (ACEN) have been established. Thus the ED has become the focus of hospital based emergency health care.

EDs are categorised by ACEM into five levels which in turn have formed the basis of similar categorisations in a number of jurisdictions. For example, in Queensland this is known as the Clinical Services Capability Framework (CSCF). The role, and level of function, of hospital based EDs are categorised according to various factors including the type of hospital in which it is located, its geographical location, whether it is in the public or private sector, and the place of the hospital within the health system network. Subsequently, EDs are grouped into one of the following categories [16]:

1. Major referral
2. Urban district
3. Major regional/rural
4. Rural emergency services
5. Primary care/remote rural emergency services.

Under Medicare arrangements, free access to public hospital EDs is guaranteed for all Australians and other entitled persons. Hospital EDs are medically staffed by a mixture of consultant emergency physicians, specialists in training, senior medical staff, and junior doctors. At the time of writing, over 1000 specialists in Emergency Medicine had been trained in Australia. Nursing and allied health staff, some of whom have specialist training in the field, complete the staffing of EDs. The staffing profile varies with the categorisation and the role of the ED.

Of the five categories listed above, only the first three levels are accredited by ACEM for training purposes. There are 763 public acute and psychiatric hospitals in Australia; most of which are small rural hospitals. ACEM has accredited 88 of those EDs in Australia for specialist training [17]. In addition, a number of private hospitals operate EDs. In 2006-07, 47 acute and psychiatric private hospitals claimed to provide “accident and emergency” services [18]. Public EDs offer service that is funded at corporate level on a fee for service basis without direct charge to patients. Private hospitals EDs, however, charge a direct fee.

Ambulance Services Role and Funding Arrangements

Pre-hospital care has been categorised into two primary models:

- The Anglo-American model in which pre-hospital care is delegated to paramedics who operate under authorised protocols; and
- The European model of hospital based medical retrieval for critically ill and injured patients [19].

To these primary models may be added a further two:

- The 'Neglect' model that describes communities who have not embraced enhanced emergency health care; and
- The 'Mixed' model in which various elements of the two primary models apply.

In Australia each jurisdiction has one recognised ambulance service providing state-wide emergency response, treatment, and transport. Ambulance services are provided largely by public sector bodies although sometimes they are provided by a non-government agency on contract to the state, for example, St John ambulance in the Northern Territory (NT) and Western Australian (WA) [20]. The full function of ambulance services includes the provision of emergency pre-hospital care and transport in response to sudden illness or injury; inter-hospital transport; non-emergency transport; coordination of patient services in multi-casualty events; and access to patients in confined and hazardous areas. Some ambulance services also provide community education and community safety obligations such as first aid training and the fitting of baby capsules in domestic vehicles. In addition to publically funded ambulance services there are a small number of private ambulance services that operate non-urgent patient transport.

The funding and organization of Australian ambulance services varies between jurisdictions and involves a combination of direct state or territory contribution, a subscription scheme, and/or user charges. Queensland introduced a unique funding strategy in 2003, termed the Community Ambulance Cover (CAC). CAC was paid as a levy surcharge added to each resident's electricity bill. This scheme was abolished from July 2011.

Aero-medical Retrieval and Inter-facility Transport Services

Fixed wing aero-medical services are provided by the Royal Flying Doctor Service, state ambulance service, or contracted service providers. Rotary wing services are mostly provided by State or Territory based organisations including Police and Emergency Services aircraft, and other service providers funded in large part by government contributions.

First Aid Organisations

First aid organisations play an integral part in Australia's Emergency Health System. These organisations include St John Ambulance, Red Cross, Surf Life Saving, Royal Life Saving, and various commercial training and service providers. These organisations provide community education, as well as first aid services to sporting and other community events.

Emergency Health System Coordination

The complexity of Australia's EHS requires a system wide approach to patient management, incorporating considerable inter-facility transfer. Specialist services such as

neurosurgery, spinal injuries, burns management, and hepatobiliary are not universally available at all facilities, including the larger ones. In addition, because of the peculiar geography and demography of Australia, aerial transfer is an essential component of the system. Transfers are performed by a variety of means depending on distance, urgency of transfer, and acuity of care needed during transfer. This includes road, rotary or fixed wing transport, with care provided by ambulance, nursing or medical staff. Nursing and medical staff may come from local hospitals, especially for road transfers. Aero-medical services are increasingly comprised of dedicated retrieval teams. In Queensland these are operated on contract by a range of providers including Careflight Medical Services, RFDS and community helicopter providers.

A number of jurisdictions have sought to better coordinate system operations by centralising ambulance dispatch around a single emergency dispatch number supported by dispatch protocols. In addition, Australia has introduced telephone advisory services (e.g. 13HEALTH in Queensland) as a means of providing medical advice to the community in an attempt to reduce the burden on EDs and ambulance services.

Finally some jurisdictions have also established centralised medical advisory and coordination services. In Queensland this is known as the QEMS Clinical Coordination Centre which, as part of Retrieval Services Queensland, operates from bases in Brisbane and Townsville and provides 24 hour specialist medical advice, and coordination of retrieval and transfer.

3. Congestion in EHS: Contextualising Demand

Congestion of EHS is caused by a combination of input, throughput and output factors [21]. The development of new clinical technologies and enhanced skill sets for treatment, investigation, and management, coupled with recognition of enhanced outcomes from early intervention for many conditions, has resulted in more being done for patients both in the pre-hospital environment and within the ED. Patients now receive enhanced clinical care in the ED which often prolongs their stay. At the same time the increased utilisation of inpatient beds reduces the capacity of EDs to access beds for patients requiring admission (Access Block) [22]. The result is that EDs are congested with patients waiting to be seen to and admitted, limiting the ED's capacity to receive patients and prolonging waiting times. Ambulance crews also face delays in unloading patients into the ED (Ramping). This congestion in EDs and ambulance is a direct result of increasing demand and utilisation of EHS.

Demand for Emergency Health Services is growing in Australia [23-26] and elsewhere in the western world, most notably in the UK [27-29], the US [30-32] and Canada [33-35]. Similar effects have also been reported in Japan [36, 37].

The growth and ageing of the population are contributors, but these factors alone cannot explain either the extent of the growth in demand or the variations in utilisation rates observable across jurisdictions within Australia, and between Australia and other similar nations. The incongruence between population and utilisation growth is shown in Table 1: comparing statistics for ED and ambulance usage between Australia and England.

Table 1: Annual Growth in Demand for EHS in Australia and England (%)

	Ambulance usage			ED usage		
	Qld	Rest of Australia	England	Qld	Rest of Australia	England
EHS Demand	4.4 ¹	3.3 ¹	6.5 ²	0.8 ³	2.9 ³	2.0 ⁴
Population growth ⁵	2.2	1.1	0.5	2.2	1.1	0.5
65+ population growth ⁵	3.0	2.0	n/a	3.0	2.0	n/a

1) Ambulance incidents from 1999-00 to 2008-09; Data extracted & calculated from: CAA's Annual Reports, various years (see Trends section). 2) 999 calls from 1997-98 to 2006-07; Source: [27: 1]. 3) ED occasions of service: 1998-99 to 2007-08; Data extracted & calculated from: AIHW's Australian Hospital Statistics, various years (see Trends section). 4) Data sourced & calculated from: [38]. 5) Queensland & Australia: [39]; England: [27: 11]

The drivers behind the increased demand for EHS have not been comprehensively explored. Without this knowledge, management strategies to support effective system function and clinical efficacy for this patient group cannot be adequately developed. Demand for Emergency Health Services is not problematic per se. However, when it is grouped with resource limitations and congestion, and consequent patient and staff outcomes, it becomes an area of concern for all stakeholders. This includes recipients and providers of health care as well as policy and decision makers and researchers.

This section examines the currently available literature on the phenomena of congestion in Emergency Health Services and how demands for services impacts on both the system and the patients.

Congestion in EDs

What is the meaning of Congestion in EDs?

Terms such as congestion, crowding, and overcrowding have been used interchangeably in the literature to indicate a high level of occupancy or mismatch between the number of patients entering the ED and the number of patients departing the ED. While these terms seem relatively self-explanatory and ED staff may “feel” that they can recognise when the ED is overcrowded, the need for a measurable definition of congestion is necessary to pave the way for development of objective measures of performance [40]. As yet there is no universally agreed upon definition or measurement of ED congestion; the Australasian College for Emergency Medicine defines ED congestion as:

“The situation where ED function is impeded primarily because the number of patients waiting to be seen, undergoing assessment and treatment, or waiting for departure exceeds either the physical or staffing capacity of the ED” (ACEM, 2002: 340).

Emphasising the “functional impediment”, and not the excessive number of patients, as the major indicator of congestion this defines “congestion” in terms of its consequences. Therefore, an excessive number of patients which does not “impede” the function of the ED, according to this definition, cannot be considered as “congestion”. Since it is very difficult, if not impossible, to measure the degree of “dysfunctionality” within an ED, the above definition provides no useful criteria by which to measure the extent of the problem of ED congestion.

An alternate perspective is that of the clinicians within the system. From this perspective, high levels of patient presentations are considered as stressful and the resultant distress can potentially cause the service to become dysfunctional.

Other more practical definitions emphasise the imbalance between the number of patients and available resources. For example, Cowan and Trzeciak defined ED congestion as “an extreme volume of patients in ED treatment areas, forcing the ED to operate beyond its capacity” [41: 291]. Such definitions are easier to operationalise and investigate, and can be included as part of an ED data collection process to allow for real-time monitoring of the ED, and adoption of appropriate solutions in time.

Congestion is a factor of demand for services, resulting in reduced capability and blockage of access to inpatient beds. It is also contributed to by the nature of the demand for service, such as with high acuity patients (Australasian Triage Scale 1 and 2), who have higher admission rates, generally require ED stretchers, and have more impact on congestion than lower acuity patients in the waiting room.

Congestion is also a factor of the service capability available. It is difficult to define bed numbers within an ED as patients may be managed in a bed, on a trolley in the corridor, in a chair, or remain seated within the waiting room. As such the capacity of the ED is not limited to the number of beds or designated patient spaces.

Defining congestion within EDs is not simple since the denominator (number of patients under treatment) is varied by the severity and complexity of the patient group, and the treatment space is varied by not only the physical environment but by the nature of the patient accommodation (beds, chairs, trolleys etc) [42, 43].

Consequences of ED congestion

The consequences of ED congestion impact patient outcomes, staff outcomes, and system-wide outcomes.

Patient Outcomes

Review of the literature on the negative impacts of ED congestion shows that it threatens public health by compromising patient safety [41, 44-46], reducing timely treatment [47, 48], increasing patient waiting times [49] and decreasing patient satisfaction [55].

Increased In-Hospital Mortality

A retrospective stratified cohort analysis of patient mortality ten days after ED presentation was measured in relation to occupancy rate as a proxy measure for congestion in the ED at The Canberra Hospital, Australia. The mortality rate was significantly higher at overcrowded times (0.42%) than non-overcrowded times (0.31%). The relative risk of death was 1.34 (95% CI: 1.04-1.72). Detailed analyses showed that the overcrowded times were also associated with a higher number of patients presenting within the urgent triage category range, which was in turn associated with delays in commencing treatment, higher chance of leaving without assessment, and higher mortality rates [3]. However, even after controlling for triage category, congestion was still associated with excess death [3].

In another retrospective study of ED occupancy (as a measure of congestion) in three tertiary metropolitan hospitals in Western Australia, the investigators analysed the mortality rate on specified intervals after admission to ED using three years of data spanning from July 2000 to June 2003. Using an Overcrowding Hazard Scale (OHS), the researchers found that regardless of age, diagnosis, urgency, mode of transport, referral source, or hospital length of stay, an OHS of larger than 2 was associated with relative increase in deaths at two days (Hazard Ratio=1.3, CI: 1.1-1.6), seven days (Hazard Ratio=1.3, CI: 1.2-1.5) and thirty days (Hazard Ratio=1.2, CI: 1.1-1.3) after admission [4].

Negative Impact on Timely Treatment

ED congestion has been linked to delays in timely treatment of patients [47, 48, 50-52]. A systematic literature review of twenty-seven articles related to the effects of ED congestion reported that treatment delay was among the commonly studied effects of ED congestion [53]. A retrospective cohort study of patients presenting with severe pain to an ED found

that congestion of the ED was significantly and independently associated with delays in delivering analgesia to patients at two stages of triage and room placement. Results showed that the delay from triage, increased by 6% for each waiting patient, and 18% for each 10% increase in the bed occupancy rate. The delay from room placement increased by 2% for each waiting patient, and 6% for each 10% increase in bed occupancy rate [52].

Hwang [2] found that “higher ED volume and greater number of patients requiring admission in the ED was associated with delays to timely antibiotic treatment” for patients admitted with community-acquired pneumonia. In a separate study Hwang found that ED congestion was associated with poor pain management in older adults with hip fracture [1]. Congestion has also been found to be associated with lengthier wait by ED patients [49] which may lead to an increase in the number of patients who leave without being seen by medical staff.

However not all studies have found this association between ED congestion and timely care. For instance, Chu and Brown found that access block as a measure of congestion was not associated with delays in treatment [54].

Lowered ED & Hospitalisation Satisfaction

Patient’s satisfaction and its relationship with ED congestion have been under-studied. In a rare survey of patient satisfaction with ED care and overall hospitalisation experience, Pines and colleagues [55] studied 1469 patients with a total of 1501 episodes of attendance in ED or hospitalisation. They found that regardless of patients’ age, gender, race, and illness severity, all measures of ED congestion (e.g. prolonged boarding time, occupancy, treatment time, hallway placement and waiting time) were negatively correlated with ED and overall patient satisfaction.

Furthermore, longer waiting times and delays in care process may lead to a considerable number of patients leaving the hospital without seeing a doctor or leaving before the treatment has completed. Not much is known about return rates and the related adverse outcomes [56], but the few studies available suggest that those who walkout from public EDs are more likely to be lower acuity patients, have lower socio-economic status, or originate from a non-English speaking background [57]. A relationship between walkouts and possible adverse outcomes for the patient are also suggested[58].

Staff Outcomes

Occupational Health & Safety

Working in an ED is stressful and potentially more dangerous than other health care sites [59-61]. While we did not find any studies that related occupational stress and injuries among ED staff to congestion, one can logically assume that an overcrowded ED is more likely to add to the normal job stress or to foster an environment where violence may be provoked more easily by patients or visitors. Gates and colleagues studied 241 ED workers in five US hospitals of whom 115 had experienced 391 assaults by patients and visitors in the six months prior to the interviews [62]. Similarly, Mayhew and Chappell studied 400 health workers including 200 nurses, in four urban and rural public hospitals in an Australian state, and found that nurses rostered in ED, drug and alcohol services, and

mental health and dementia wards were more likely to have experienced violent events than other nurses [60].

Difficulty with Staff Retention

Workplace stress related to congestion, workload pressure, and insufficient resources has been shown to be associated with ED physicians reducing their working hours [61-64].

Lower Quality Teaching for Junior Staff

Studies do not abound in this area. In their discussion paper, Atzema and colleagues [65] raised the question of whether ED congestion has affected the quality of teaching and learning in EDs. They reported that no studies had been conducted to show the impact of congestion on resident education. Furthermore, they argued that “without comparable research on ED teaching 10 to 15 years ago, it is impossible to know with certainty whether teaching has worsened since then, either overall or as a result of ED congestion” [65: 277]. And, with changes in the teaching and learning methods and techniques, evaluating the impact of congestion on the quality of education is even more complicated.

In a small survey of medical residents the authors reported no significant correlation between congestion measures and effectiveness of educational communication among senior and junior staff. Educational effectiveness was measured using a variety of scales including "didactic and bedside teaching, attending availability, efficiency in patient management, approachability, professionalism, and adequacy of supervision" [66]. The study however suffers from methodological deficiencies including: (a) small sample size (n=184); (b) low response rate (42%); and (c) validity and reliability of measuring all the above scales through a short (one page) questionnaire responded by medical residents at the end of their shift evaluating the quality of teaching they had received. It is not clear how valid it is to measure the quality of teaching merely through students' evaluation of the teaching. Furthermore, the low response rate could well indicate that non-respondents had a different view of the quality of teaching but, due to power relations between junior and senior staff, the opposite views were not expressed.

Despite little information, it is reported anecdotally that a high volume of lower acuity patients in an ED usually creates a situation where junior doctors are assigned to fast tracking these patients in order to reduce the pressure on the emergency room. This may inadvertently reduce the amount of time that may otherwise be spent on training and supervising the junior staff. Given the relatively common perception among medical staff that triage category 4-5 patients are more suitable for GP attendance, a high number of these patients in an ED may affect junior staff's perception and satisfaction with their “specialist” training as well as with the discipline of Emergency Medicine itself.

System-wide Outcomes

Problems associated with ED congestion are not restricted to the individual ED involved. The consequences may spread well beyond the walls of the department and hospital.

Pressure on Resources & Facilities / Ambulance Diversion & Ramping

Ambulance diversion and ramping are two of the immediate effects of ED congestion. These effects may have consequent impacts on the provision of ambulance services to other patients in need as well as imposing extra costs on the pre-hospital care system [67, 68]. The impact of ED congestion on ambulance diversion is so evident that it has been commonly used by many studies as the sole indicator of congestion [68-70]. However, even when an ED is overcrowded it will not necessarily opt to divert incoming ambulances.

ED congestion and the resulting ambulance diversion may also adversely impact neighbouring facilities. Vilke and colleagues [71] studied the impact of congestion, as measured by ambulance diversion, in one ED on the neighbouring hospital. They hypothesised that commitment to avoid ambulance diversion in ED (A) would reduce the "reciprocating effects" for ED (B). They measured the amount of ambulance diversion in both EDs for one week; then added some resources to ED (A) to cope with the demand and avoid ambulance diversion. The results were measured again for one week in both EDs during the trial. The week after the trial, ED (A) resumed its normal operation and the researchers studied the number of hours of ambulance diversion for one week. Controlling for the number of ambulance runs, the results showed a dramatic decrease in ambulance diversion during the trial period compared to the weeks before and after. Diversions from ED (A) decreased from 19.7 hours to 1.4, ED (B) eliminated ambulance diversion from 27.7 to zero hours.

Increased Costs

There is a scarcity of studies demonstrating the actual costs to the ED/ health system as a direct result of congestion. Bayley and colleagues calculated the additional costs associated with extended length of stay in the ED for chest pain patients awaiting an inpatient bed in a hospital in the US [72]. While they did not find any association between the costs and ED congestion they conceded that the extended length of stay reduced the ED revenue because of the reduced turnover of patients. They also suggested that costs may even be higher when the number of patients who leave without being seen is taken into consideration. Little is understood about the impact on the presenting condition when patients leave the ED without being seen and whether or not alternative health assistance is sought. Further detailed and large scale studies are required on this impact.

Political Sensitivities/Tensions

In Australia, media focus on health system responsiveness, wait times for urgent services, and the costs of health care is strong; and serves to both influence and sensitise public opinion surrounding ED issues. A search of one state newspaper revealed that approximately fifty articles about hospital EDs, and over 200 articles about ambulance services in Queensland, were written in 2009 alone [73]. Kennedy and colleagues analysed the content of four major Australian newspapers to evaluate their portrayal of emergency medicine [74]. They selected 176 articles published during the one year period from mid-2003 to mid-2004. The articles covered twenty topic areas from seventeen news sources. ED overload was the most prominent topic (38%) followed by solutions to ED problems (16%)

and errors/negligence (13%). Overall, the tone of the articles were highly negative when reporting ED overload or potential negligence [74: 120].

Factors Affecting ED Congestion

Congestion of EDs is a function of many factors both intrinsic and extrinsic to the broader health system. The Input-Throughput-Output model provides a rational and all inclusive approach to the understanding of ED patient flow [21]. Under this model ED congestion can be attributed to the collective impact of demand (input factor), processes related to provision of care to the patient in the ED and the hospital (throughput factor), and access to ongoing care for the patient after being seen and treated at the ED (output factor). Each of these factors can be influenced and affected by other forces such as population shifts, seasonal variations, individual preferences and circumstances, resource limitations, and policy changes.

Input-Throughput-Output Model

Developed by Asplin and colleagues, the “Input-Throughput-Output” model provides a multifaceted conceptual structure to examine the process through which EDs receive, treat, and discharge patients. The model, initially developed to answer the heightening issue of congestion in hospital EDs, offers useful tools for understanding internal and external factors that affect ED functionality and outcomes [21]. Figure 1 summarises the model.

Figure 2.
The input-throughput-output conceptual model of ED crowding.

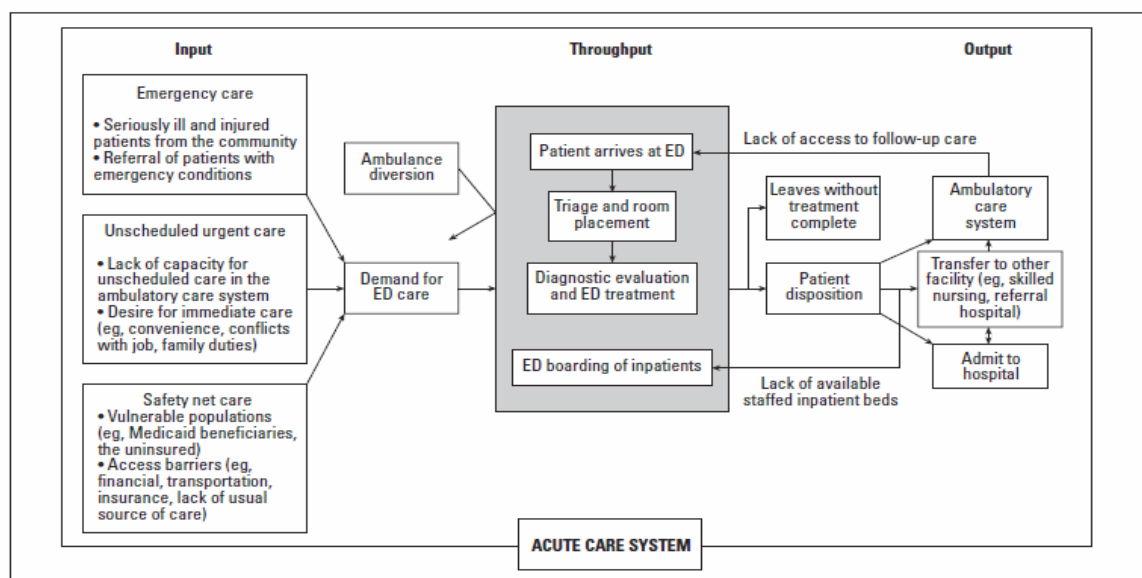


Figure 1: The Input-Throughput-Output Model of ED Congestion

[Reprinted with permission from: 21: 176]¹

Major components of the input-throughput-output model are defined below.

¹ Reprinted from: Annals of Emergency Medicine, 42:2, Brent R Asplin, David J Magid, Karin V Rhodes, Leif I Solberg, Nicole Lurie, Carlos A Camargo Jr, A conceptual model of emergency department crowding, page 176, © 2003, with the kind permission from Elsevier.

Input Factors: Demand for EDs

Demand for EDs is not restricted to urgent or emergency conditions; a range of clinical factors and patient needs must be considered including personal preferences for perceived better care, convenience, accessibility, affordability, and availability of the services at all times.

Entry overload, defined as an “overwhelming number of patients presenting to the ED in a short space of time” [75], is a major factor of ED congestion attracting attention from scholars and policy-makers. Earlier studies focus on “inappropriate users” and point to them for the excess load on EDs [76]. However, more recent studies have moved away from blaming the user and toward finding out why demand for ED services is on the rise. Focus is shifting towards how demand can be managed to prevent or minimise ED congestion and improve the care for patients [77-80]. This is in line with the general acceptance that it is not the volume of patients in ED, but rather the blocked access to a source of ongoing care, that is strongly linked to ED congestion [41, 81].

While studies abound in the areas of ED congestion and associated issues, little is known about why demand for ED services is on the rise, particularly in countries like Australia where there are strong primary health care services. As this is the main focus of the research project, we will further develop this factor in subsequent chapters and focus here on the other components of the model.

Throughput Factors

Throughput factors describe internal processes and procedures for care of patients in the ED from the moment they arrive to the moment they are discharged or depart. These factors include triage, medical testing, diagnosis, treatment, and boarding until discharge or inpatient admission. Lack of adequate resources (e.g. staff and beds) can mean that when input levels increase the ED may not be able to function at the standard expected of it. Throughput factors do not directly affect demand. Rather they are to be seen as a part of the whole demand-supply chain and, particularly when demand for EHS cannot be met by the system, as part of the solution to issues such as congestion, access block, and staff shortage.

In their editorial “If you want to fix congestion, start by fixing your hospital” Asplin and Magid [82] emphasise the importance of a holistic approach to solving the issue of congestion [see also: 83]. From their perspective, while extra demand - generated particularly by lower acuity patient groups - can increase the overall workload in an ED and affect its functions, it is not the main reason for ED congestion. Congestion, as measured by length of ED stay for patients needing to transfer to an inpatient bed, is strongly associated with ED outflow. Measuring congestion by length of stay, while helpful, is a simplistic approach that does not reflect the overall processes, functions, and complex outcomes of ED operations.

Studies show that access block is the most important factor responsible for causing congestion in EDs. However no matter how fast the high complexity patients are transferred to inpatient beds congestion of EDs by low acuity patients still creates an extra burden on ED staff and resources which affect their efficiency and effectiveness in

providing care to patients. This highlights the significance of incorporating throughput and output factors to create a holistic approach in dealing with the problem of EHS congestion.

Throughput factors that are considered to be of greatest significance in relation to ED congestion are briefly described here. Registration or triage is the first point of contact for patients. Any delays or shortcomings at this stage not only create a backlog of waiting patients but can also adversely affect the health of patients and consequent processes and functions in the ED [21]. Slow registration/triage may be a result of other factors such as staff shortage or inexperience, inefficient equipment (e.g. IT systems), and inappropriate location of the triage station.

Care and service processes are also crucial components of throughput factors [21]. A study by Yoon and colleagues in a large urban ED in Canada examined the association between major ED service processes and length of stay. They found that specialty consultation and use of imaging and laboratory testing had varying effects, depending on the type of consultation and tests, on prolongation of stay in ED [84].

Additionally Hoot and Aronsky [53], in their systematic review of causes and effects of ED congestion, reported staff shortage, reduced capacity, and boarding of inpatients as commonly cited throughput factors associated with ED congestion [see also: 21, 85]. The level of seniority of the staff, as well as the number, is crucial to improving ED performance. This was shown during a five-day strike by junior doctors in Middlemore Hospital in South Auckland. This study found that increasing the number of senior ED specialists (FACEM) shifts during the strike period from 25% to 75% resulted in dramatically reduced ED length of stays for inpatient admissions (from 451 to 258 minutes) and discharges (from 233 to 144 minutes); significantly increased the percentage of patients seen within prescribed maximum time for triage categories 2-5 by 21% to 55%; and reduced the number of patients who did not wait to be seen from 4.4% to 0.8% [86]. Similarly, White and colleagues [87] found that reviews by senior staff after patients have been seen by junior doctors reduced inpatient admissions by 11.9% and admissions to the acute medical assessment unit by 21.2%. Inappropriate discharge was prevented in 9.4% of cases, and the number of appropriate appointments to outpatient facilities rose by 34.6% [87].

Output Factors

Output factors encompass all services, facilities, procedures, resources, and events happening outside the ED which relate to follow-up care for the patient when exiting the ED. These include inpatient admission, hospital resources, transport services, and community capacities (e.g. post-acute care, primary and specialty care). Shortage of resources in any of these areas affects ED function, leading to congestion, ambulance ramping and diversion, and associated negative patient outcomes and staff stress. Output factors are not only associated strongly with ED congestion, but also may have direct or indirect effect on excess demand for emergency services. For instance, incomplete treatments, or patients who leave without being seen may ask for an ambulance at a later date or return to the ED for further treatment.

The discharge process can be a difficult and time consuming task, further complicated by unavailability of resources outside the ED. Access block to inpatient beds has been blamed

as the main cause of ED congestion [22, 50, 54, 81, 83, 85, 88-100]. Accordingly, increasing the number of beds, and solutions of this nature, have been recommended to solve the problem [91, 93]. However this solution may only be effective if other measures such as training, recruitment and retention of staff (medical, nursing etc), costs, and other infrastructure requirements are also taken into account.

In addition to access block other issues in the discharge process can also create further delays and elongate patients' stay in the ED. For instance, detailed and accurate documentation of patient charts and records (discharge summary), long waits for pathology and radiology testing, long waits for reviews by the inpatient unit, availability and organisation of post-acute care (such as GP or specialist referral), arranging follow-up care for patients requiring care in the community or nursing homes, and arranging transport or ambulance transfers, can all impact on the ED's function [21] by unnecessarily occupying beds and taking up staff's time [e.g. making numerous follow-up or transfer calls, see: 101].

Evaluation and Usefulness of the Model

The Input-Throughput-Output Model is a multi-level model which provides a reasonably comprehensive representation of ED congestion and its causes. However studies to show its strengths or weaknesses are lacking. The model is too broad and multi-dimensional to allow for a thorough test of it in one single project. Studies that have dealt with ED congestion have mainly focussed on a small number of factors such as internal ED processes, patient streaming or fast-tracking, and inpatient bed availability. Methodologically, causal relationships among various factors in the model have not been tested and the complexity of measuring all factors simultaneously can mean that it may remain a theoretical model which cannot be validated. It is however logical and the team that introduced the model have attempted to develop measures that are agreeable to the research community [102].

In relation to the current project, the Input-Throughput-Output model presents a logical framework to identify and classify factors that affect demand for Emergency Health Services and how such demand may, in conjunction with other factors inside and outside the health system, lead to congestion. The study will not, however, be able to show a cause-effect or linear relationship among such factors. The most relevant part of the model to this project is the input component, related to demand for EHS at personal and societal levels. The rest of the model will assist in identifying solutions to EHS congestion, but the main focus of the project will be to identify demand and related factors. This can then be used to model and predict such demand and offer solutions that help manage it.

Congestion in Ambulance

What is the Meaning of Congestion in Ambulance?

While congestion in the ED demonstrates points of common understanding, such as congested physical space, congestion in the ambulance domain is less visible because the patient treatment space is mobile. However, since each ambulance can only carry one

patient, the concept is potentially more easily definable by relating demand to available ambulance crews.

One measure used in the description of demand for ambulance services is Unit Hour Utilisation (UHU), defined as the percentage of time an ambulance unit (vehicle plus crew) is occupied in providing patient care services.

$$\text{UHU} = \frac{(\text{No. of patients per time period}) \times (\text{Average time per patient})}{(\text{No. of available units per hour}) \times (\text{No. of hours})}$$

The Input-Throughput-Output model is equally relevant to pre-hospital care. Pre-hospital care is particularly vulnerable to congestion in the ED. The most obvious of these potential effects is the inability to respond to emergency cases, within the set time targets, as a consequence of vehicles and crews being detained for longer periods before handover to ED staff. This phenomenon is referred to as ramping and can be measured by prolonged times between arrival at hospital and the transfer of the patient to an ED bed; described as the 'Off-Stretcher' time. It is not yet evident in Australia or Queensland whether ramping of ambulances at EDs is associated with significant delays in attending to or treating/transferring patients, or significant adverse outcomes for patients.

Measurement of ambulance congestion is further complicated by variability in service response models. An ambulance is not merely a vehicle but also a crew (usually at least two persons). However ambulance service capability can also include paramedic only responses without patient transportation capability. Patients may or may not be transported following initial care or may be referred to alternate sources of ongoing care.

Consequences of Ambulance Congestion

In critically ill cases such as cardiac arrest, motor vehicle accidents, and major trauma there is acceptance that time delay [103] or longer transport times can have a relationship with mortality [103-106]. However, there is little evidence beyond anecdote in regard to the consequences of ambulance congestion. Although delayed response time is likely to impact on morbidity and mortality, as patients remain longer in pain and discomfort than would otherwise occur, the evidence is not yet compelling. Further research is required in this respect.

Ambulance congestion may also impact on the health and safety of personnel in this already stressful and hazardous occupation [107, 108]. A study by Maguire and colleagues showed that the number of work-related injuries amongst ambulance paramedics in the US was similar to those for fire fighters and police officers and were seven times above the national average [109]. Another study found that occupational fatalities of ambulance officers were also similar to fire fighters and police personnel in the US [110].

At the system level, ambulance congestion may lead to resource restrictions and delayed service provision. Ambulance diversion has also been used as a proxy indicator for ED congestion. A study in a US city investigated whether hospital ambulance diversion would affect the ambulance resource availabilities [111]. The study retrospectively compared total out-of-service time, time from departure from scene to arrival at hospital (transport

interval), and time from arrival at hospital to availability for another call (turnaround time) between diversion and non-diversion times (control group) in one of the city's hospitals in 2002. A total of 1403 emergency transports were analysed and the results showed no significant difference between diversion and non-diversion times with regards to the outcome variables. In contrast, a Canadian study by Schull and colleagues found that ED congestion substantially and significantly increased ambulance transport interval time by approximately four minutes for chest pain patients [112]. A comprehensive review of internationally published articles confirms the scarcity of research in this area [113].

At the social level, ambulance congestion may give rise to public dissatisfaction, media scrutiny, and political sensitivities surrounding potential shortcomings in service provision. It is common in Australia to see disparaging media reports and articles about ambulance personnel and performance [e.g. 114, 115-120].

Factors Affecting Ambulance Congestion

No studies were found to have examined factors that may lead to congestion in the use of ambulance services. However, it is reasonable to assume that rising demand for ambulance from one side, and ED congestion leading to ambulance ramping and diversion from the other, are significant contributors to congestion in ambulance service delivery systems. Further studies to quantify these factors are warranted.

4. Demand for ED

This section will first attempt to define demand in the context of ED service utilisation and provision. Secondly, factors contributing to demand for ED services will be reviewed.

Defining Demand for ED

The word “demand” is used in the context of Emergency Health Services studies without clarification as to what it means. One of the words most widely used by economists – “demand” refers to “the amount of a goods or services that people are both willing and able to buy” and not just measuring “what people want” [121]. It represents the “choice-making behaviour of consumers” [122: 58]. In combination with “supply”, these two forces drive market economies, economic policies, and behaviours. What people want or need but cannot afford is not defined as demand. Demand in economic terminology constitutes a degree of both desirability (manifested as willingness to buy) and affordability based upon which both producers (supply) and consumers (demand) regulate their behaviours relating to the production and consumption of goods and services [123: Ch. 4]. In practice, the amount paid for purchasing goods and services during a specific period of time counts as “demand” in economic calculations.

In the Emergency Health Services setting it is difficult to measure demand in terms of the amount of money consumers (patients) pay to purchase such services. These services are usually offered to patients either without cost to patients or at a very low cost, particularly in countries with universal health care plans such as Australia. A review of the literature on demand for EHS shows that authors have used the word demand to refer basically and interchangeably to the number of people who use such services. For example, the number of patients visiting an ED [30, 124-136]; the number of calls made to ambulance telephone line; or the number of patients who use ambulance services [27, 28, 137-144]. Therefore, in this context, demand appears to be seen as equal to utilisation or usage.

For the scope of this project, demand for ED is used to refer to the following concepts:

- 1) Number of patients attending an ED over a year;
- 2) Number of visits by a patient over a period of time to EDs;
- 3) Preference for ED over other forms of acute care such as GPs or other primary health centres.

One problem with this conceptualisation is that it does not take into account the differences in individual patients’ circumstances, such as their illness, which can impact the level of resources needed to treat those patients. In economic terms demand is calculated by the price tag and therefore the value of goods and services supplied are taken into consideration, while in EHS terms demand is defined as equal to the number of user visits or preferences and does not consider the value of services supplied. To overcome this deficiency, measures such as considering triage score and case-mix are required to further

fine tune the concept of demand in the emergency health context. In addition triage score will be used, wherever available, to qualify the demand.

Factors Affecting EHS Demand

This section will explore factors driving demand for EDs under three subgroups: individual factors, health system factors, and societal factors. However it is difficult to simply categorise these factors. Many issues are considered in the literature, and there is considerable overlap between them. Therefore some of these issues are discussed in areas that may not seem immediately intuitive.

Individual factors

Socio-Demographics Characteristics

Age

ED utilisation varies by different age groups. Statistics consistently report that, except for infants and young children, elderly patients comprise a disproportionately higher percentage of ED users [145, 146]. The impact of this is not universally felt by individual EDs. Chu and colleagues examined the trend for older age groups' attendance at a major tertiary ED in Brisbane, Australia. Their findings showed that despite the overall increase of 7.7% in the number of presentations to the ED during the study period (2002-2006), the overall number of attendances by patients 65 years or older decreased by 3.1% [147]. The authors speculated that population migration in the hospital's catchment area might have played a role in the shifting of the trend data.

On the other hand, there is evidence that some younger age groups are also high ED attenders. For example, in Australia, about 28% of ED presentations are attributed to people 15-34 years of age [23]. This group also comprises 28% of the Australian population [148]. Similarly, the age group 22-49 years showed a consistently high presence at EDs in the US [145].

Higher ED utilisation rates vary by age group. Wolinsky and colleagues [149] studied 4310 patients aged 70 or older in the US. The study collected information about the respondents' attendance at EDs, reasons for that attendance, and demographic, socio-economic, and psychological characteristics of patients. They found that high-intensity ED users were more likely to be older, not living in rural counties and have greater morbidity, functional, and psychological problems [149]. The contributing factors are not limited to the above list and further studies are required to provide detailed evidence in this regard.

However general trends in ED utilisation do tend to coincide with an ageing population. Overall, the proportion of older users of ED services is higher than their proportion in the population [147, 150]. With this ageing population it is only logical to conclude that demand by this group will also grow [29, 151-154]. Roberts and colleagues analysed a ten year trend (1993-2003) for ED visit rates among older patients in the US. They showed that the number of visits by the 65-74 age group increased by 34%, the highest increase in comparison to other age groups [152].

In Australia, patients aged 65 and over comprised 17.7% of ED presentations in the period 2007-08 [24] while they form 13.1% of the total population [155]. In addition, with increased life expectancy, it seems that the rise in ED use is shifting to age groups beyond 85 years. Publicly available data for ED presentations by age groups shows that while ED presentations by patients aged 65-84 years decreased from 14.3% in 2003-04 to 13.9% in 2007-08, the number for 85+ group increased from 3.4% to 3.8% [24, 156]. This does not correspond with the population growth for both age groups in which the 65-84 group increased from 11.3% to 11.5% of the population and the 85+ group increased from 1.4% to 1.6% [39].

It is not unreasonable to suggest that with increased life expectancy comes inevitable physical, emotional, psychological and social predicaments that will require urgent or continuous medical attention where EDs will be an immediate point of contact. At the same time, younger people often engage in risk taking behaviours including drug and alcohol misuse and contact sports that predispose them to injury and thus to ED presentation.

Gender

Gender may also be a factor affecting demand. While the number of men and women are almost equal in the Australian population, men – except for those 75 and over – consistently outnumber women in ED utilisation [23, 24, 156-158]. Similar findings have been reported in other countries. Older men were more likely to visit a Montreal ED [159]; younger males were higher ED users for non-urgent conditions [160] and mental health problems [161] in the US; and men outnumbered women in an Israeli ED [162]. Despite these observed gender differences, explanations are inconclusive as to why men differ from women. One might assume that young adult males presenting with emergency conditions as a result of assaults or injuries related to risk taking behaviours and alcohol or drug use may account for at least part of the excess utilisation. However, detailed analyses controlling for confounding variables are necessary [163].

Living Arrangements

While it is suggested that people living alone or without family support, particularly in older age groups, are more likely to visit EDs [146] little information is available to prove or reject the claim. A small sample study of 74 elderly patients (65 years or over) attending a community based hospital in Sydney, Australia showed that, while a large majority of the patients lived in their own homes, women were more likely to present than men and women were more likely to live alone than men (51% versus 7.7%) [164].

A more recent study of 894 patients 17 years and over in an ED in Edmonton, Canada, found that after controlling for other variables, living alone (OR=0.6, CI: 0.4-0.8), and residence in assisted living circumstances (OR=0.4, CI: 0.1-1.2) significantly reduced the chance of seeking alternative care before presenting to ED. Forty-seven percent of the group who attempted to access alternative services before visiting the ED called a physician's office, and 14% contacted a regional health information line. Sixty-three percent of the patients who called a physician's office and received advice were directed to visit the ED. Similarly, 58% of the callers to the health information line were advised to go to the ED [165].

Socio-Economic Status/ Inequality

Socio-economic status affects individuals' health seeking behaviour and utilisation of health services. In the US, the homeless population have a much higher rate of using ED services [166]. Furthermore, the study by Kushel and colleagues interviewed 2578 homeless and marginally housed persons and found that 40% of the respondents had at least one ED visit in the year prior to the interview. Remarkably about 8% of the participants reported nearly 55% of the ED encounters. Poorer health status, being a crime victim, and medical co-morbidity were major factors that increased the likelihood of visiting the ED [166: 782].

In Australia, an Aboriginal or non-English speaking background is also associated with higher use of EDs. Thomas and Anderson reviewed the literature on the use of EDs by Aboriginal and Torres Strait Islanders in Australia. Their review of thirty-one major articles concluded that Aborigines and Torres Strait Islanders were twice as likely to attend EDs compared to other Australians; and that they tend to be younger and have a lower socio-economic status [167: 70].

A secondary analysis of ED data in New South Wales (NSW), Australia, showed that 5.7% of patients attending NSW public hospital EDs left without seeing a doctor [57]. Over 4.3 million records of data covering the period between January 1999 and December 2001 were analysed. After adjusting for triage category and time, they found that the walkout rate before treatment was significantly higher among Aboriginals (24%), patients without private insurance (24%), and those living in socio-economically disadvantaged areas (39%) [57: 438].

While socio-economic status and affordability of health services may be correlated with use of EDs in systems where the patient is charged directly, these factors may play a secondary role in Australia where primary health care is available to everyone through Medicare.

Health Insurance

ED congestion and increasing demand for emergency services seem to be associated with the lack or limitation of health insurance [85, 168]. However, this is not necessarily attributable to Australia because of the universal availability of Medicare. The question is whether primary medical care is affordable to those who seek ED care instead of visiting a GP. Australian Institute of Health and Welfare reports that bulk-billing rates by GPs, as an indicator of the affordability of medical care, has been rising from 68% in 2003-04 to 78% in 2006-07 [158: 318]. While this is good news, the bulk-billing does not show the full picture of medical costs. A GP encounter may include extra costs such as imaging, pathology tests, and medication; these costs are all absorbed by the medical system if the patient attends an ED. Furthermore, bulk-billing is usually available on special terms and conditions such as to pensioners, children, and the unemployed and does not encompass all who may not be able to afford paying an excess out-of-pocket fee. Ragin and colleagues reported that affordability (cited by 25%) and limitations of insurance (15%) were among the top five reasons their research participants stated for attending an ED in the US [168: 1162].

Illness and Injury Type, Severity and Urgency

Studies are consistent that demand for ED care is associated with actual and/or perceived presence of an illness/injury as well as actual and/or perceived acuity and severity/urgency of the condition [53, 78, 151, 168]. This is not to say that all patients attending an ED have an acute illness, or that all people with an acute illness attend an ED [169, 170].

All patients presenting to an ED in Australia are assessed using the Australian Triage Scale (ATS) of 1-5. During 2006-2007, just below 1% were assigned category 1 (*Resuscitation*); 8% were categorised as 2 (*Emergency*); 32% as 3 (*Urgent*); 47% as 4 (*Semi-urgent*); and 12% as 5 (*Non-urgent*) [23: 94]. While the majority of cases presenting at an ED are considered as “proper” ED cases, it is the semi-urgent and non-urgent cases (ATS 4-5) that attract debate. These latter groups have commonly been referred to as “inappropriate users” or primary care patients who could or should be seen by GPs or other primary care practitioners, and who do not require the specialised services and facilities of an ED [78, 168]. Green and Dale [76] argue that this view is mostly taken retrospectively after a patient has been assessed by a triage nurse or a doctor and, when prospective research was conducted, they found that ED users had problems “not typical of the general practice workload” [76].

More recently, Bezzina and colleagues [78] reviewed definitions of the “primary care patient” from the perspective of ED utilisation. They identified various criteria that were used to define “appropriateness” including: low urgency and/or acuity, self-referred, care deliverable by a GP, and no need to be admitted. According to their reviews, depending on which criterion is used, 10 to 90% of the same group of patients can be classified as “inappropriate” [78].

Few studies have attempted to investigate the reasons for attending an ED from the viewpoint of the patients; of the available studies similar patient attitudes and perceptions are shown for seeking ED care. Ragin and colleagues [168] in a nation-wide sample of hospitals in the US, surveyed a total of 1579 patients and 2004 charts to determine the reasons for patients attending the ED. Factor analysis showed that the most common reason cited by patients was “medical necessity” (95%) followed by “ED preference” (88.7%) and “convenience” (86.5%). Similarly, the study by Callen and colleagues [77] in a rural Australian setting concluded that despite disagreement between patients’ views and triage rating of the urgency of the ED presentation, the majority of the patients either considered their condition as urgent or believed that their attendance was justifiable for other reasons such as unavailability of alternate care, and need for special services.

It is therefore significant to learn why patients have been increasingly attending hospital EDs. Studies in this area do not abound. Masso and colleagues compared patients’ and ED staff’s perceptions of the reasons for ATS Category 4 or 5 patients visiting five EDs, instead of a GP, in the Illawarra region in New South Wales, Australia [171]. They surveyed 130 nurses, 30 doctors and 397 patients. The study showed a marked difference between health practitioners’ views and that of the patients’. Nurses and doctors were of the view that costs related to a GP visit and medical tests were two of the top three reasons patients in those categories attended an ED. This was in sharp contrast with the patients’ views which saw these costs as being of little importance to their decision to visit the ED. For the patient,

the perceived severity of their condition and requirement for immediate medical attention ranked the highest [171]. While there is the likelihood that patients justified their ED visit *post hoc*, the main critique of this study is that it assumes that Category 4 and 5 ATS patients are GP patients. The evidence does not support this view; according to the 1992 National Health Strategy Report No. 10 [cited in: 172], and based on a retrospective analysis of a sample of ATS 4 and 5 patients, less than 15% of these patients could be classified as GP-type patients.

Availability of and Access to Alternative Services

Demand for EDs is compounded by actual or perceived unavailability or difficulty accessing alternate health services [146]. Reeder and colleagues' study of 455 patients visiting a rural tertiary ED in the US found that "limited access to primary physicians" was one of the predictors of increased demand for EDs between the two study periods of 1992 and 2000 [151]. Another study in the UK with a small number of participants (n=200) reported that being unaware of alternative after-hours primary care services was one of the top five reasons for ED attendance [173]. However this is not true for all patients attending an ED. There is evidence that many ED patients first seek primary care elsewhere. Han and colleagues [165] reported that 61% of the 894 patients participating in their survey of two urban ED sites in Canada had visited an alternative care provider before coming to the ED. A majority of those who did not seek alternative care were aware of such services, but it was mainly perceived that the ED was a better place to go for reasons such as better care and convenience.

Perceived Quality of Care

Studies suggest that patients who visit an ED directly, or after seeking alternative primary care, are of the belief that the care they receive in an ED is of a higher quality than the care provided by a primary health practitioner [165]. Considering that many patients regard their condition as serious enough to justify seeking urgent medical attention [for instance see: 77] it makes sense for them to visit an ED where appropriate facilities and expertise will assure them of the care they need.

Convenience

Desire for immediate care and convenience seem to play a significant role in the patients' decision to present to an ED. The convenience associated with the availability of after-hours and same-day care, a one-stop shop, as well as fewer conflicts with work and family duties make EDs more attractive to patients who would otherwise have to make advance planning to visit a GP [21, 77, 146, 168]. Ragin and colleagues reported that 86% of their respondents visited the ED for convenience reasons such as: no need to make an appointment, geographical proximity and easy access, and being the only place open. The convenience scale was only moderately correlated ($r=0.44$) with the medical necessity scale, implying that convenience was a big factor in patients' minds when attending an ED [168: 1162]. Similarly, the study by Callen and colleagues in a rural ED in Australia reported that, of those who did not perceive their condition as an emergency, 29% of patients attended the ED because of unavailability of the GP, 7% because of proximity, and 5% because they did not have a GP [77: 714].

Peer Pressure/ Request by Others

Encouragement or request by others (bystander intervention) can play a role in an individual's decision to attend an ED. Bengner and Jones interviewed 200 patients admitted to a teaching hospital in England to ascertain the actions taken by them prior to attending the hospital [173]. Their results showed that 54% of the patients sought help themselves; friends or family sought professional help on behalf of 35% of the patients; and in the remaining 11% help was sought by bystanders or other individuals not well known to the patient. Further, their study found that there were significant differences between when the patients decided to attend an ED (21%) and when others (family or friend 34%, bystanders 52%) made such decision [173].

Frequent/Repeat Users

Repeat users (frequent flyers) reportedly place a relatively high pressure on ED resources and are commonly blamed for ED congestion [146]. While there is an abundance of information about these users, difficulty arises around the appropriateness of the definition of who is a frequent user and whether their frequent visits to EDs are justified [53, 174-177].

Hunt and colleagues conducted a large survey of North American individuals (n= 49 603) and included questions about the number of times they had attended an ED in the twelve months prior to the survey. After weighting the results they concluded that 8% of the respondents had visited EDs at least four times and would fit the definition of a "frequent user". This accounted for 28% of all visits to the ED in the survey period. The results showed that "poverty, poor physical health, poor mental health, and having five or more outpatient visits were all independently associated with the likelihood of frequent ED use in the adult population" [174: 4].

Adams and colleagues studied a group of 293 asthma sufferers, with repeat visits, at two teaching EDs in South Australia in order to identify influencing factors [176]. After adjusting for socio-demographic factors, they found that asthma severity, and not having a written asthma action plan and coping mechanisms, were major predictors of repeat visits to EDs.

Dent and colleagues [178] analysed 12 490 presentations by 500 "repeat users" to an inner city ED in Melbourne, Australia, and concluded that only 28% of these visits might have been potentially appropriate for primary care. Similarly Fuda and Immekus in their state-wide analysis of Massachusetts ED data reported that 1% of patients comprised 17.6% of ED visits in 2003. However, with frequent users more likely to be "of high intensity" (30.5%) than infrequent users (23.6%), with higher admission rate to inpatient beds (18.8% vs 14.2%) they concluded that "frequent users tend to be sicker than infrequent users" [179: 12]. While some frequent users may be regular ED attenders, this study showed that most of them use EDs at a higher rate temporarily over a specific period and not at all at other times.

Critique

The individual factors described above all contribute to demand for ED services to some extent; and their impact varies from person to person and from one ED to another. Factors

that affect a person's decision to seek health care are multifaceted, and depending on the situation each may play a heavier or lighter role in determining which course of action is taken. Broadly speaking, the factors can be categorised as objective and subjective.

Objective factors, such as the presence of an illness/injury, age and gender, are the ones that are collected by health practitioners and can be viewed in a patient's chart and can be analysed without much difficulty. However, even when such analyses are performed further questions emerge as to why differences exist between various groups (e.g. age, gender) in terms of their ED utilisation. Subjective factors such as health beliefs and perceptions will help to clarify the demand for EDs but surveying subjective factors is not as easy and reliable as it is for objective ones.

Many studies that have attempted to understand the patients' reasons for visiting an ED (subjective factors) experience the following shortcomings:

- a) Retrospective approach: this approach to surveying patients who have attended an ED cannot determine a causal relation between attitudinal factors and the decision to attend an ED when an illness/injury strikes. On the other hand, conducting a prospective and longitudinal study for understanding how and to what extent each of these factors may cause a person to seek ED care in the presence of an illness/injury, may prove too difficult or pragmatically unattainable.
- b) Available studies have included only a few factors each and it is not possible to compare the weight each factor plays independently in leading the individual patients to seek ED care. On the other hand, it is understandable that a survey of ED patients has to be short enough to be conducted very quickly and cannot contain all the possibly relevant variables.
- c) Most studies cited here have a relatively small sample of participants making it difficult to generalise the findings.
- d) Studies are generally restricted to one or two ED settings in a rural or urban context; hence the findings may not be reproduced in, or generalised to, different settings.
- e) Studies also vary in terms of their sampling criteria such as patient's age groups, types of illness/injury, and socio-cultural settings within which the Emergency Health Services operate. Therefore, the reliability of the findings is limited to the circumstances within which studies were conducted and cannot be generalised to other different groups.

Health System Factors

The impact of system-related factors is not as well documented. Health system factors may include insurance and rebate policies, availability of alternative primary care services to patients, hospital size, type and geographic location, and catchment population. According to AIHW data, geographic location of the public hospitals was related to the number of patients attending EDs. In 2005-06, the ratio was 256 patients per 1000 population in major Cities, 385 in regional areas, and 854 in remote areas [158: 363]. The figures for Queensland were 245, 381 and 866 respectively [158: 364]. The report suggested that these variations may be related to factors such as the patterns of diseases and injury, availability of other

health care services, and poorer health of the indigenous communities concentrated in remote areas of the country. Similarly, the proportion of ED presentations varied according to hospitals' peer grouping (i.e. Principal Referral and Specialist Women's and Children's hospitals, Large hospitals, Medium hospitals, and Small Acute hospitals). In 2007-08, 66% of Australia's ED presentations were to Principal Referral and Specialist hospitals, compared to 22% to Large hospitals, and 12% to other hospitals [24: 109].

In the absence of convincing evidence, it may be reasonable to conclude that factors such as those explained above, including shortage of affordable alternative services (e.g. bulk-billing GPs), cultural and ethnic variations, inadequacy of Medicare item numbers for services that can be offered by GPs, inability of the health care system to provide care for an acute exacerbation of a chronic problem outside the ED, or capacity for emergency care in the pre-hospital care system (e.g. nursing homes, ambulance) can impact on the magnitude of demand for ED services [21, 180].

Societal Factors

EDs are essential components of a health system that provide comprehensive care to all members of the public, particularly in societies or among social groups where other sources of care are less affordable or accessible. They provide essential and primary care services to groups who would not be able to access or afford health care otherwise. A report to the US Senate in 1993, on the utilisation of EDs in the US, attributed uneven growth and usage to "uninsured, elderly, and more seriously ill patients"; large numbers of patients with "non-urgent conditions"; and those without any "primary health care provider" [150: 19-25]. The report added that, due to Congress legislation in 1985 ensuring all US citizens can access emergency care regardless of ability to pay, EDs experienced an increase in the number of uninsured or financially troubled patients who used EDs as their primary source of health care [150: 13].

On the other hand, in societies such as Australia with universal health coverage systems, increased use of EDs may be associated with structural factors such as aging of the population and increasing prevalence of chronic diseases. Australians are living longer. The mean age of the Australian population has increased from 34 to 38 years old in the past two decades and the number of persons above the age of 85 has been growing at an average annual rate of over 4% [181]. It has been shown that this is associated with an increase in the usage of ED and ambulance services [146, 182]. Also related to an aging population is the increasing prevalence of chronic illnesses and mental and physical disabilities [183: 321] which require increasing use of medical care resources and in particular the EHS [182, 184].

EHS utilisation load may increase quickly as a result of seasonal outbreaks of diseases such as influenza [53]. Natural disasters and disease pandemics are also important factors in rapidly surging demand for ambulance and EDs. In addition, normative factors such as general expectations of higher quality care, better specialised services, easier accessibility, and increased convenience for people who may not need urgent medical attention, can lead to a greater demand for ED services. These expectations if not met effectively and quickly may lead to social dissatisfaction within the general population and within individual patients who have to wait long hours to receive care.

5. Demand for Ambulance

This section will define demand in the context of ambulance service utilisation and provision and also identify those factors which may contribute to demand for ambulance services.

Defining Demand for Ambulance

As described previously, for purposes of this project “demand” refers to the “utilisation” of Emergency Health Services. Therefore, economical and philosophical notions of “demand” are not discussed. The demand for ambulance services refers to a multifaceted phenomenon involving the number of calls to the ambulance service, the number of incidents, the number of ambulances dispatched and the number of patients transferred or treated. This operational definition is interwoven with the ‘Call Cycle’ (i.e. the length of time from unit dispatch to time clear). The Call Cycle (due to treatment and transport intervals) has an impact on unit availability and thereby on demand placed on the ambulance system. Ambulance services can be provided as both scheduled (such as pre-booked medically advised transport and inter-facility patient movement) and unscheduled acute care requiring an immediate response.

It is difficult to compare studies, nationally and internationally, due to the different criteria used to report on the demand for ambulance services. For example, in the UK the number of calls made to the emergency 999 telephone line is used to measure demand for ambulance services [27, 29, 185-188]. In Australia, at least three measures are used: incidents, responses, and patients [25, 158, 189]. An incident is an event that results in a demand for ambulance resources to respond. An ambulance response is a vehicle or vehicles sent to an incident. There may be multiple responses/vehicles sent to a single incident. A patient is someone assessed, treated or transported by the ambulance service. There may be no, or multiple, patients per single incident.

Predictors of Demand for Ambulance

Studies about factors and drivers of demand for ambulance are limited. The studies published to date use demographic factors to explain demand rise and speculate about other potential reasons why people call the emergency telephone number and request an ambulance. Attempts to quantify major predictors for demand have focused on general population trends and disease patterns that may correspond with an increase in demand. The important, but difficult to measure, issue of what leads individuals to use such services have remained significantly unstudied.

The Australian Institute for Primary Care (AIPC) identified possible demand drivers for Ambulance as:

- “demographic change;
- social change;
- clinical and epidemiological factors;
- changes in medical practice and patient management;
- accessibility of alternative services;
- quality and accessibility of Ambulance services; and
- community expectations, including awareness of benefits of early intervention” [144: 11].

The AIPC report provides some quantification with regards to population growth, age structure of users, and disease trends. In this report, age and gender structure are used to forecast demand despite the acknowledgement that these factors only explain 25% of growth in ambulance utilisation between 1996 and 2001 in Australia [144: 75].

A later investigation by PricewaterhouseCoopers (PwC) commissioned by Queensland Treasury reviewed a number of studies and summarised the list of major drivers as follows:

- population growth;
- ageing population;
- acuity of illness;
- increase in the burden of chronic diseases;
- distance from hospital;
- need for admission upon arrival at the emergency department;
- pricing and attitudes regarding Community Ambulance Cover (CAC) levy;
- availability of alternative health care options and changes in medical practice and patient management;
- accessibility of other forms of transport;
- quality of service and fast response times;
- socio-economic status; and
- community expectations, including awareness of the benefits of early intervention [190: 31-36].

Socio-Demographic and Illness-Related Characteristics

In their landmark study, Clark and colleagues used sixteen weeks of Australian ED data in 1996-97 (n=10 229) to quantify the independent impact of demographic and illness related factors on demand for ambulance. They found that arrival by ambulance to the ED was significantly higher among the elderly (PR= 2.9, 95% CI: 2.3-3.6); patients triaged categories 1-2 (PR= 1.9; 95% CI: 1.6-2.2) or triage score 3 (PR= 1.5; 95% CI: 1.3-1.7); and patients with mental (PR= 4.2; 95% CI: 1.8-10.0); nervous (PR= 2.7; 95% CI: 1.1-6.3) or trauma (PR= 2.3; 95% CI: 1.0-5.2) conditions. However, it was lower among those married or in a de-facto relationship (PR= 0.6; 95% CI: 0.6-0.7); and divorced, separated or widowed (PR= 0.8; 95% CI: 0.7-0.9); compared to singles. Ethnicity, gender and time of day were not associated with usage [141]. The authors did not report the overall percentage of variance explained by their

analytical model. Furthermore, the data only included those who were transferred to an ED while about 11%-15% of the patients attended by paramedics each year are not transported [25: Table 9A.23].

A study at five urban teaching hospitals in the US surveyed 2315 patients using a questionnaire. The study found that ambulance usage was nearly two times higher among patients aged greater than 65 years; three times more among higher severity patients; and one and a half times higher among poorer groups. However, multivariate analysis did not show any association between ambulance usage and race, sex, education, Medicaid coverage, frequency of ED use, living arrangements or primary physician availability [191]. A more recent analysis of 80 209 patients' records arriving by ambulance to EDs in the US found that ambulance patients were far more likely to be triage category A (resuscitation) (OR=51.3; CI: 33.1-79.6); or B (emergent) (OR=9.2; CI: 6.1-13.7); involved in motor vehicle crash (OR=7.1; CI: 6.4-7.9); gunshot/stab wound (OR=2.1; CI: 1.5-2.8); or fell 0-10 ft (OR=2.0; CI: 1.8-2.3). The patients were twice as likely to have Medicaid Traditional or Medicare Traditional insurance and arrive weekdays between midnight and 8am. Patients aged 65 and over were 30% more likely to arrive by ambulance (OR=1.3; CI: 1.2-1.5) [192].

While it is important to minimise unnecessary demand, one has to be cautious about situations where people do not call an ambulance even though it is necessary. Brown and colleagues conducted a randomised controlled study with 962 community members (control group) and data collected from 875 chest pain ED arrivals (trial group) [169]. On average 89.4% of the control group expressed they would call an ambulance in a chest pain event, but in reality, only 23.2% of the trial group actually called an ambulance. The use of ambulance was associated with living alone (OR=1.9; CI: 1.3-2.7); having a tax-based payment plan (OR=2.1; CI: 0.7-6.4); and belief that it might be serious e.g. heart attack (OR=1.7; CI: 1.1-2.7). On the other hand, non-usage was associated with self medication (OR=0.5; CI: 0.3-0.9); communicating with own doctor (OR=0.4; CI: 0.2-0.8); and waiting for pain to go away (OR=0.6; CI: 0.4-0.8) [169].

Social support is also linked with ambulance utilisation [193]. In a general population postal survey of 1576 participants (response rate of 41%) about the use of ambulance services, awareness of other health services and medical and social conditions in Swansea, UK, Snooks and colleagues found that ambulance users were significantly more likely to live alone, to be ringing on behalf of another person, and to be calling on behalf of someone with a chronic condition [187].

Beliefs, Knowledge and Choice

The studies described to date use ED or ambulance data to analyse associations between the use of ambulance and patient characteristics. However, they do not canvass patient decision making about when, or why, to use an ambulance. The decision to seek ambulance assistance can be made by the patient themselves, by bystanders and/or by general practitioners, or by other medical providers. Speculation has arisen, in response to the increasing demand for emergency health services, that patients may not be making sound decisions with regard to what is an emergency and what is not. Defining "appropriateness" of emergency health service use is challenging - what appears to the patient to be a sound

decision based on their experience of their symptoms may prove, retrospectively, to be flawed once diagnosis has been confirmed. Generally speaking, emergency health awareness campaigns encourage patients to call for emergency assistance if they have any concerns about their health and/or wellbeing [193]. Until relatively recently, few of these campaigns have provided specific descriptions of symptom presentation which would constitute an emergency. An exception to this would be the campaigns run around cardiac health and the early warning signs of an acute myocardial event.

Jacob and colleagues surveyed 311 patients in a community teaching hospital in Bethlehem, Pennsylvania, of whom 22% used ambulance [194]. They asked patients the reasons why they did/ did not use ambulance and compared the responses to physicians' view of appropriateness of ambulance usage by the patient. For users, the main reasons stated were: someone else called (46%), too sick to go other way (18%), having no other means (10%) and doctor's suggestion (5%). Nonusers mentioned the following major reasons for not calling an ambulance: not sick enough (54%), had someone else to bring them in (21%), could not afford ambulance (9%), and ambulances should be there for sicker patients (6%). ED physicians agreed with the transport method in 68% of users and 92% of nonusers ($\kappa=0.61$, $p<0.01$) [194]. This study again clearly shows the discrepancy between health staff and patient perceptions.

Shah and colleagues focused on 930 elderly patients at an urban medical academic centre in the US, and their impact on ambulance, using the following factors: socio-demographic characteristics – (age, gender, education, race); living alone; health beliefs (perceived illness seriousness, seeking physician help, feel physicians help a lot); enabling characteristics (insurance, usual source of care, report trouble getting care); and need characteristics (comorbidity, quality of life, health and pain perception, mental health, physical and social function, deficiencies in daily living activities, onset of symptoms within 4 hours prior to seeking care). Logistic Regression analysis showed that only age group 85 years and above (OR= 1.6; CI: 1.0-2.5); worse physical function (OR= 1.1; CI: 1.0-1.2); deficiencies in activities of everyday living (OR= 1.4; CI: 1.2-1.6); and onset of symptoms in the previous 4 hours (OR= 3.1; CI: 1.8-5.1) were statistically significantly associated with ambulance utilisation. The most common reasons stated for ambulance usage were: “immobility (33%), illness (22%), request by others (21%), instruction from health care provider (10%) and lack of transportation (10%)” [154]. It is to be noted that the study only included older patients and, as the authors acknowledge, the data were collected only during day time shifts, and that questions regarding the patients' health beliefs were not “sufficiently sensitive to detect differences” between users and nonusers [154: 58].

“Unnecessary” Calls

As was discussed for ED demand a large body of older studies, and much public debate, tend to focus on “unnecessary”, “inappropriate” or “non-urgent” use as a significant factor in increasing demand for Emergency Health and ambulance services [for some examples, see: 185, 195, 196-205]. Brown and Sindelar reviewed clinical data of 145 patients in a community hospital in Connecticut and found that “unnecessary” use, as determined by a medical practitioner or hospital admission, was 22% among private insurance holders, 34% among Medicare members and 85% among Medicaid members [198]. Similarly, using a

larger sample of 626 patients from five EDs in New York, researchers found that 11% (71 cases) of transports were “medically unnecessary”. Of these 59% were Medicaid recipients, 74% were less than 40 years of age, and 38.5% used ambulance because they had no other means of transport [197].

Various investigations, using similar methods, have estimated “unnecessary” ambulance use ranges from 11.3% in New York, US, to nearly 50% in Glasgow, Scotland [205: 213]. All these studies relied on the judgement of a medical practitioner (e.g. GP or emergency physician or nurse) or patient’s ED disposition record (i.e. discharged home without follow-up) to determine the inappropriateness of ambulance use. It is debatable that patients intuitively know if a condition is an emergency or not. The method used in the studies mentioned is flawed as it ignores the fact that a patient is not a medical professional and does not have access to all the medical tests or equipment available to a medical practitioner when making a diagnosis. It is the patient or their carers who decide to attend, based on their perception of need and urgency, that explains their rationale for decision making [206], therefore using discharge status is questionable as such an outcome can only be known after proper medical procedures have been followed.

In a differently designed survey of 2029 residents in Yokohama, Japan, Kawakami and colleagues asked respondents if they would call an ambulance under three hypothetical non-emergency scenarios. Probit regression analysis showed that male and older respondents and those who had used an ambulance before were more likely to select to call an ambulance. Conversely, respondents owning a car or those with knowledge of a primary emergency medical centre that opened at night were less likely to call an ambulance. Another noteworthy finding of the research was that the incremental effect of each factor varied from one scenario to another. Participants were more likely to state they would call an ambulance if a child or a painful situation was involved. Authors estimated that non-emergency ambulance calls increased by 10-20% because of socio-economic factors [200].

Emergency System Factors

Pricing is commonly referred to in the literature as a driving force to use or not use the ambulance [193]. In Queensland, Australia, introduction in July 2003 of the Community Ambulance Cover (CAC) levy to assist the costs of QAS has been referenced as a driving factor of increased demand for ambulance services in this state. This scheme was abolished as of July 2011. Using ED patients’ demographic and disease related information, Ting and Chang analysed the effects of these variables on arrival by ambulance in 2002 and 2004 (before and after CAC implementation) to an inner city adult public hospital ED in Brisbane. They found that when controlled for net impacts of presenting characteristics – illness acuity, need for admission, and older age – ambulance arrivals in 2002 increased by 14% compared to 2004. They argued that decline in “clinical acuity, admission rate, and age of ambulance users” in 2004, along with a net increase in ambulance arrivals might “represent an increase in unnecessary ambulance use” which they attributed to CAC introduction [201: 480].

A replication of Ting and Chang’s analysis for QAS Audit in another larger tertiary hospital produced similar results, prompting the Audit to support that “this is likely to have an

impact on demand as individuals are aware that they have already paid for the service and are therefore more inclined to use it. In addition, households receive a quarterly reminder that they are paying the levy when they receive their electricity bill, which maintains awareness of the levy" [190: 33].

Other factors documented as adding pressure to ambulance availability are ramping or excessive waiting time at EDs for ambulances to transfer patients [190, 207], inter-facility transfers [101, 190] and ambulance diversion [35, 208]. As mentioned earlier, these factors can add to over-utilisation of ambulance resources, leading to possible delays to patient treatment [209], and indirectly increase demand for ambulance. However, further discussion of these factors is not within the scope of this monograph.

Population Growth and Ageing

Increased life expectancy in developed countries, including Australia, combined with the prevalence of certain health conditions and disabilities is associated with growth in ambulance utilisation [193]. In Queensland, Australia, in 2006 the population grew at 2.3% per annum, which was the highest of any state in Australia for that year, with the national average being 1.5% [reported in: 190: 31]. Comparably, demand for ambulance in England (with a growth of 6.5%) is far more than the population growth of 0.5%; only 17% of the rise in ambulance demand could be accounted for by the combined effects of population ageing and growth [27: 11]. The NHS report for England also provides insightful facts about specific groups that contribute to ambulance demand such as frequent callers (usually from public places like supermarkets, nursing homes and pubs), residents in geographically deprived areas (46.5 service request per 1000 people vs. 34.3 in non-deprived areas), and binge drinkers (1 in 20 calls to ambulance) [27: 12-14]. To this can be added examples such as other substance abuse, presentations on weekend nights, and use of mobile phone activations by 'Good Samaritan' bystanders in minor car accidents [210].

In another study, Peacock and colleagues examined all emergency responses in the 16th week of the years 1989, 1996, and 1999 for possible links between demand, age and gender. They found that male patients' calls increased disproportionately compared to females; the rise in demand for ambulance was no greater in older groups than other age groups [29]. In the reports mentioned above there were no multiple variable analyses to show if any of these factors were interrelated and to what extent each factor would affect demand independently.

Geographic Characteristics

Researchers have studied links between geographic and population characteristics in specific areas, and demand for ambulance services. Peacock and Peacock examined links between the high demand for ambulance in England and geographic characteristics of the population. They analysed the association between calls made to ambulance services, in 1997 and 2002, with geographic deprivation scores and population density. They observed moderate correlations between demand and geographic deprivation, and moderate to strong correlations between demand and population density. Multivariate regression highlighted the effect of population density and weakened the deprivation impact; both

variables were associated [211]. Similar findings were reported by Cadigan and Bugarin who observed, in the communities studied, that higher demand was correlated with lower median income, a higher percentage of the population over 65 years old, and higher percentage of residents living below the poverty line[139].

Critique

In summary, ambulance demand is a function of multiple factors including:

- Individual Characteristics:
 - Age, gender, and socio-economic status.
 - Lack of alternate transport options, or unavailability of family/friends to assist.
 - Risk avoidance as seen when individuals are more aware/less willing to take risks by either not seeking medical care or by self transporting when not well.
 - Beliefs and perceptions.
 - Illness or injury condition (e.g. pain, perceived severity and urgency), need for urgent care.
 - Living arrangements.
 - Access to alternative sources of care.
- Emergency Health Services Delivery Factors:
 - Quality of care provided.
 - Provision of care to a wide range of groups and communities.
 - Effectiveness of educational campaigns.
 - Pricing, funding and expenditure policies.
 - Provision of alternative services.
 - Issues related to EDs and hospitals (e.g. ramping and ambulance diversion).
 - Lack of alternate referral pathways as seen when patients have difficulty accessing GPs, or multidisciplinary services within a relatively short time frame).
 - Availability of health information to the general community (accessibility of health information on the internet and in the community leading to increased familiarity with medical system and self diagnosis).
 - Increasing skill level of paramedics and community's trust in their capabilities.
- Societal Factors:
 - Population growth and aging.
 - Population dispersion or density, and geographic deprivation.
 - prevalence of acute or chronic diseases, and
 - Lifestyle factors including risk behaviours leading to illnesses, injuries and accidents (e.g. obesity, binge drinking).

Little is known as to why patients call or do not call an ambulance “appropriately” or “inappropriately”. No single study is able to sufficiently capture and explain the variance in demand for ambulance usage. The studies listed and discussed here are of limited scope, encompass small sample numbers, or are restricted to secondary data analysis collected by hospitals or ambulance authorities for administrative purposes. As such, similar to those

studies mentioned in demand for EDs, these studies do not necessarily reflect the reasons for the patient's decision to uptake or reject ambulance usage.

Furthermore, many of these studies use "demand" and "utilisation" interchangeably without clarifying the concepts. Demand is inclusive of, but not limited to, utilisation. To understand and estimate demand requires taking the study within the society where demand for services is actually created, rather than restricting it to the emergency medical system. Kawakami and colleagues' study in which they included the general public [200] is a step in this direction. It is understandable that studies of this kind can be expensive and difficult to conduct, and the results may not reflect or predict actual utilisation, however, only further research in this field of investigation will begin to answer the question of what drives ambulance demand.

6. EHS Demand Management

Managing demand for Emergency Health Services is a complicated and multifaceted issue compounded by political, social, economical, scientific, ethical, and ideological concerns. The public health system relies on restricted resources to provide services and has to balance its use of resources in such a way that optimum services are provided, maximum expectations are met, and minimum sensitivities are provoked. As an example of such complexities, the public health sector in Australia has been facing many challenges particularly in the areas of primary and emergency health care. Problems such as overcrowded EDs, access block, ambulance diversion and ramping, and medical workforce shortages are frequent news headlines.

In response to increasing demand, the concept of demand management in health care systems has attracted many policy makers, researchers, and other stakeholders in areas such as forecasting, planning and policy, solutions and alternatives, interventions, and evaluation. Limited health care resources result in the distribution of supply for various sections of the health system requiring cost effectiveness assessment and maintenance of equity. “Historically, the management of health services has centred on management of supply rather than management of demand” [212: 1]. Specifically relevant to this paper it is firstly important to know what factors drive demand to enable dependable forecasting; secondly, based on those predictions, solutions to manage demand need to be considered. In previous sections, factors predicting and driving demand for ED and ambulance services were discussed. In this section, major solutions aimed at easing pressure on emergency services are briefly reviewed.

Solutions/Alternatives

Policy solutions in response to EHS management have mainly focused on throughput factors, such as the implementation of triage and fast-tracking, or on output factors aimed at reducing access block and patient admissions. All of these solutions can be considered as supply, rather than demand, management. In recent decades some policy development has begun, with varying success, to aim at addressing and managing demand. Here we review some of these initiatives.

A range of interventions aimed mainly at reducing demand for Emergency Health Services by “redefining the boundaries between primary and secondary care with the aim of shifting selected services traditionally provided in the acute hospital to less resource-intensive primary and community based alternatives” have been in place for over a decade [213: 192]. These alternatives have included pre-hospital treatment such as afterhours care, ED-led GP clinics, GP Superclinics or GP cooperatives, an expanded role for paramedics, and home visits by GPs or nurses; telephone health advice such as 13HEALTH, and HealthDirect; public education campaigns; patient education and communication; drives to reduce re-admissions; establishment of user contribution to costs; and initiatives by hospitals to keep patients at home such as Hospital in the Nursing Home (HiNH) [214] and Hospital in the

Home (HIH) [215] programmes. The effectiveness of these interventions in reducing demand varies and is contested.

Providing out of hours care is one of the service interventions meant to reduce visits to EDs by those who require medical attention after-hours. However there is little support for the extent to which these services reduce ED demand, particularly as most patients who attend an ED are seen as not being GP type cases [50, 180]. For example, Krakau and Hassler [216] conducted a pre- and post-intervention analysis of the number of ED visits following the addition of a GP clinic to a Swedish university hospital ED. They found that the total as well as non-urgent number of ED visits increased (27% and 11% respectively) following the intervention. This increase was also associated with an increase in average waiting time for patients with urgent or emergency complaints from 35 minutes to 40 minutes [216]. A more recent Australian study into the introduction of two bulk-billing GP clinics in Mackay, Queensland, also reported that the clinics did not significantly reduce the absolute number of ED presentations or ED congestion [5].

Other research shows support for interventions. In Holland, a study on demand for out of hours GP cooperatives and emergency care found that GPs handled 88% of all after-hours contacts. Of the remaining 12% who presented to Accident and Emergency Departments (A&EDs) 43% (equal to 5% of all after hours contacts) were self-referrals [217]. The authors concluded that “compared to the self-referrals, the GP and ambulance services provide an effective patient filter to the A&EDs” [217: 7]. Rajpar and colleagues also support the effectiveness of after-hours clinics but point to issues that can hinder their use by patients [218]. Their small sample size of 102 patients attending either an A&ED, or a GP cooperative attached to the hospital in Birmingham, England, found that A&ED users were more likely to be unemployed, white, without a regular GP, and unaware of the availability of the GP cooperative. Those A&ED patients who knew about the GP cooperative thought that the waiting time there would be longer than at the A&ED. The authors suggest that further education, and raising awareness of the public, is needed for such clinics to operate effectively.

Telephone health advice services have similarly been faced with criticism. Many doubt that these can provide a reliable service and their effectiveness on reducing demand for Emergency Health Services, particularly ED and ambulance, are not well evidenced [90] or at best limited [219]. A study in Perth, Western Australia, evaluated compliance with advice and compared triage category of emergency presentations for HealthDirect and non-HealthDirect callers [220]. The analysis included 13 019 emergency department presentations of which only 6.5% contacted the telephone service prior to attending ED. Of 3996 callers to HealthDirect, 79% complied with advice, while 9% presented despite the advice not to. Triage distributions and admission rates for compliers and non-compliers were not significantly different. The investigators concluded that HealthDirect callers self select to attend the ED and base their decision to attend an ED on factors independent of HealthDirect advice and that “HealthDirect has a limited capacity to influence ED utilization or workload” [220: 38-39]. The study did not measure patients’ “intention to attend the ED” before calling HealthDirect.

Analysing data from UK National Health Survey, Shah and Cook [6] compared characteristics of self-reported NHS Direct telephone health advice callers with Casualty

Department users. They found that, unlike casualty users, NHS Direct callers were more likely to have lower income and socio-economic position and live in deprived areas. They also report that NHS Direct is underused by older people and ethnic minority households [6: 78]. Therefore, any intervention to reduce access to, or use of, Emergency Health Services has to be cognisant of its varying impacts on different sections of the society.

Some studies have pointed to the effect of re-admissions as a burden on the health system, particularly for conditions such as heart disease and asthma/COPD [221, 222], as these patients may need to be discharged in order to open room for new or more acute patients. In answer to this problem, programs to help patients identify health conditions and encourage them to communicate with their health practitioners [223, 224] after discharge, can reduce readmissions by assisting patients to better manage their illness [221].

However, education programs must still emphasize the need to return to the ED or contact their health practitioners if symptoms recur, as delays in re-presentation have been shown to deteriorate the patient's condition [225, 226]. Similarly, public education campaigns to reduce demand for Emergency Health Services, particularly ambulance, run the risk of deterring seriously ill patients from accessing or using them. A retrospective analysis of ambulance utilisation data for two periods before and after a public campaign for appropriate use of ambulance services in Yokohama, Japan, showed that ambulance transports reduced by 7% and 8% for patients with non-serious and serious (non-life-threatening) conditions respectively in the months following the campaign [202]. Due to the nature of the data the study was not able to establish a cause-effect relationship between the campaign and change in behaviour; nor was it clear if the reduction in ambulance demand would continue in the long term.

A perceived free service or service already-paid-for is also likely to attract higher usage by people who may not need it and would otherwise not use it [201]. However, in relation to health services, the introduction of user fees faces political, social and ethical challenges such as access inequality as well as risking patients' lives who may be deterred by the costs of services particularly at times of emergency. A study by Ohshige and colleagues in Yokohama, Japan, was an effort to determine user price that would reduce demand without discouraging medically necessary ambulance use [203]. They surveyed the general population and presented 2029 survey participants with three hypothetical scenarios based on which respondents would have to decide if they would call an ambulance for a certain fee. Their analysis showed that for both serious and non-serious scenarios participants would agree to pay up to a certain point (\$95) but after that the choice to call dropped significantly [203: 936]. It is to be noted that payment thresholds are socially and culturally specific.

Another option to reduce demand and pressure on EDs and ambulance is to expand the role of nurses and/or introduce nurse practitioners and physician assistants within an ED to attend to minor issues. Similarly, giving ambulance officers' an expanded role would allow them to treat patients with minor problems at scene without the need to transfer them to EDs [190, 227-230]. However, because of medical liability concerns, implementation of this option may face resistance.

Acknowledging the increasing demand for ambulance services in Queensland, the QAS Audit Report provides solutions and recommendations to reduce demand [190: 92-104]. In summary, these include demand management strategies at three stages:

- 1) before the call is made to “000”;
- 2) after the call is made but before an ambulance is dispatched; and
- 3) after the ambulance has been dispatched but before the patient is transported to a hospital emergency department.

Three major strategies are supported in order to reduce demand at each point:

- Strategy 1 - Community Education Campaign;
- Strategy 2 - Improved Clinical Triage and Referral Processes;
- Strategy 3 - Alternative Response Options and Treatment at Scene.

The QAS report also acknowledges that “lack of a price signal has clearly contributed to demand pressures” on ambulance in Queensland [190: 4]. The report suggests that a co-payment model with a modest contribution by patients can help reduce demand for non-urgent cases without putting seriously ill patients at risk. Several models have been suggested, however the Queensland government declined to introduce a co-payment.

7. Theoretical Framework for the Study of EHS Demand

All people become sick; some more frequently and some more severely than others. As a result, social systems have in place formal and informal procedures and institutions to help their members preserve their health and return to a normal (healthy) status after they fall ill. In return, sick members are expected to seek proper care in order to get well and assume their social duties as soon as possible. With exceptions such as terminal and degenerative diseases this seems to be the norm in many societies. However, not all people behave the way expected when they experience health anomalies. They may or may not seek medical care, and when they do, they may follow various courses of action such as self-treatment, taking over-the-counter (OTC) drugs, using alternative/complementary/traditional therapies and visiting GPs or hospitals [231].

It is this diversity in utilising health services that has for decades attracted much interest among public health specialists, social psychologists, sociologists, anthropologists and other scholars. The two fundamental questions of interest are:

- 1) What do people do in different social groups and societies to retain and/or regain their physical and mental health?
- 2) What are the reasons behind what people do and the way they behave when they experience illness?

This project aims to understand the reasons individuals decide to use ambulance or attend EDs, even if their illness may not seem to be emergent or urgent. The theoretical models discussed here essentially attempt to simplify and explain the major factors that guide or cause individuals to seek care at time/s of acute or emergency health concerns. These models have rarely been used before in emergency care settings, but they have been found to provide powerful tools in understanding the utilisation of Emergency Health Services, and the “development of more effective interventions, and the translation of evidence-based practices into routine clinical care” [232: 1122].

In this section, we first look at the models of health behaviour from three perspectives:

- 1) Individual decision making, including: Health Belief Model, Health Services Utilisation Behaviour, Theory of Planned Behaviour, and Decision Making Theory;
- 2) Interpersonal decision making, including: Social Cognitive Theory; and
- 3) Community-supported decisions and reinforcement, including: Social Support and Social Network models.

Secondly, cultural elements affecting health behaviour will be discussed. And finally, an integrated model will be introduced for the purposes of the current research project aimed at studying demand for EHS in Queensland, Australia.

Models Explaining Health Behaviour

Health Belief Model

Developed in the 1950s, the Health Belief Model (HBM) has been widely used as a conceptual framework to study the relationships between human attitudes, perceptions, and actions in health related areas; particularly in regards to preventive health and the reduction of risk taking behaviours [233, Ch. 3: 45-65]. In summary, the model explains that individuals are more likely to take action if they see themselves as vulnerable to a risk; see benefits in a prescribed action; consider barriers as possible to overcome; and whether they have guidelines about how to proceed. These are in turn affected by other factors such as their psycho-social and demographic characteristics. The main components of the HBM are defined below [233: 46-50].

Perceived susceptibility: person's perception about the possibility of contracting a health condition. This could range from believing that a health problem might actually happen to them (e.g. getting skin cancer if overexposed to sun) to accepting a medical diagnosis in the case of an established illness.

Perceived severity: describes individual's feeling about the seriousness of the threat posed by a potential or real medical condition. In conjunction, perceived severity and susceptibility are also called *perceived threat*.

Perceived benefits: if a condition is perceived to be serious, and the person considers they are vulnerable, then they should find it beneficial to follow a specific course of action (e.g. using sun protection or vaccination).

Perceived costs (barriers): if the health action is considered too difficult then the chance of progressing towards adopting the health measure slims despite the perceived benefits. Such barriers can include financial hardship, access to facilities, bad experience (e.g. painfulness), fear of side effects, and so on.

Cues to action: triggers awareness and readiness to act in a person who has formed a positive perception in previous steps. Hard to measure as a concept, this can include a health advertisement or poster, a subliminal message, or a close friend getting the condition.

Self efficacy: this concept was later added to the model by other researchers and describes the belief in one's ability to "successfully execute the behaviour required to produce the outcomes" [233: 49].

Evaluation and Usefulness of the Model

Findings from research using the HBM in the past five decades support the usefulness of its components for different kinds of health behaviour. For instance, while perceived susceptibility and threat are stronger predictors of preventive behaviour, perceived barriers better predict a patient's decision to seek care. However, there is concern about measuring HBM constructs and there is no specifically tested and validated measure of the concepts

defined above. Universal standard measures are not available and various investigators have developed independent research instruments. The reliability of the measures and their inter-relationships (construct validity) are also not well known [233: 50-53].

In relation to the current project, the HBM can provide useful concepts in understanding the reasons people may take into account before utilising Emergency Health Services, be it a call to ambulance or attending an ED. All the previously mentioned components of the HBM can be used in this study to explain, in part, the demand for pre-hospital and hospital-based emergency services.

Health Services Utilisation Model

Based on the HBM, and further developed in the 1960s and 1970s, the Health Services Utilisation Model (HSUM) was specifically designed to study the factors that influence a person's use of health and medical services. The model comprises predisposing factors such as family composition and health beliefs, enabling factors such as family and community resources, and need factors such as illness or symptoms [234: 153-159]. An individual's decision to use health services depends in the first instance on the perception of the illness and its symptoms. However, mere presence of ill-health symptoms does not necessarily lead to actively seeking care through health service organisations. Other factors as mentioned will enable or hinder such action. The model was later advanced to differentiate subjective and objective indicators of access to health services. As such, objective access would include availability of resources, and subjective access would encompass perceptions such as convenience, affordability and quality [234: 160].

Evaluation and Usefulness of the Model

The model was used and amended by its original developers and was very popular among researchers in the US and other countries throughout the 1970s to 1990s. Many used it to identify utilisation patterns of health services among various social and ethnic subgroups. However, the model can only be used as a guide to studying health behaviour. It poses major methodological issues including: an incomplete list of independent variables; difficulty in establishing causal pathways; operationalising and measuring concepts; and generalising findings from studies of specific utilisation behaviours [234: 161-164].

In relation to the present study, the model can be used in conjunction with other models to offer a more comprehensive framework as to the understanding of why patients use ambulance and hospital EDs and whether different social and ethnic groups display different patterns of utilisation. An important component of the model for this discussion will be the objective and subjective access indicators.

Theory of Reasoned Action and Theory of Planned Behaviour

Developed in the 1970s by Ajzen and Fishbein, the Theory of Reasoned Action (TRA) was further advanced to the Theory of Planned Behaviour (TPB) from the 1980s onward [235: 170]. According to this theory, human behaviour is not only the result of held beliefs and norms, but is also mediated by the "intention" to behave and the level of "control" one

perceives to have, or actually has over necessary resources, in order to perform the action. Therefore, some degree of reasoning and rationality has to happen before an action is taken by the individual. The concept of “intention” is an important addition to the model, providing an improved framework to explain human action. This dimension combined with the added strengths of “motivation” and “perceived control” help to rationalise why, in many circumstances, individuals fail to act in accordance with personal beliefs and accepted social norms. Another major concept in this model is “compatibility” between intention and behaviour; a specific behaviour (e.g. quit smoking) requires specific intention, while general behaviour (e.g. healthy lifestyle) is compatible with general intentions [233: 69-74, 235: 171-176].

Evaluation and Usefulness of the Model

In their meta-analysis of the TPB model, Conner and Sparks noted that the two components of attitudes and intentions were strong predictors of behaviour, while others were in the range of medium to strong. However other factors of the model need to be taken into account. Firstly, self-reported subjective information may not produce the most accurate prediction, and so has to be supported by other objective or multiple measures. Secondly, the model recognises that cultural background and demographic variables act as external factors whose impacts are mediated through beliefs and intentions. Studies show that some factors may have direct effect on intentions and behaviours. And finally, the model assumes that all human behaviour is based on rational choice and decision making and is not able to account for irrational, non-cognitive and spontaneous behaviours [235: 179-180].

In positive relation to the current project, the concepts of intention, normative beliefs and behavioural control can be used to enrich the integrated theoretical framework to help understanding demand for EHS.

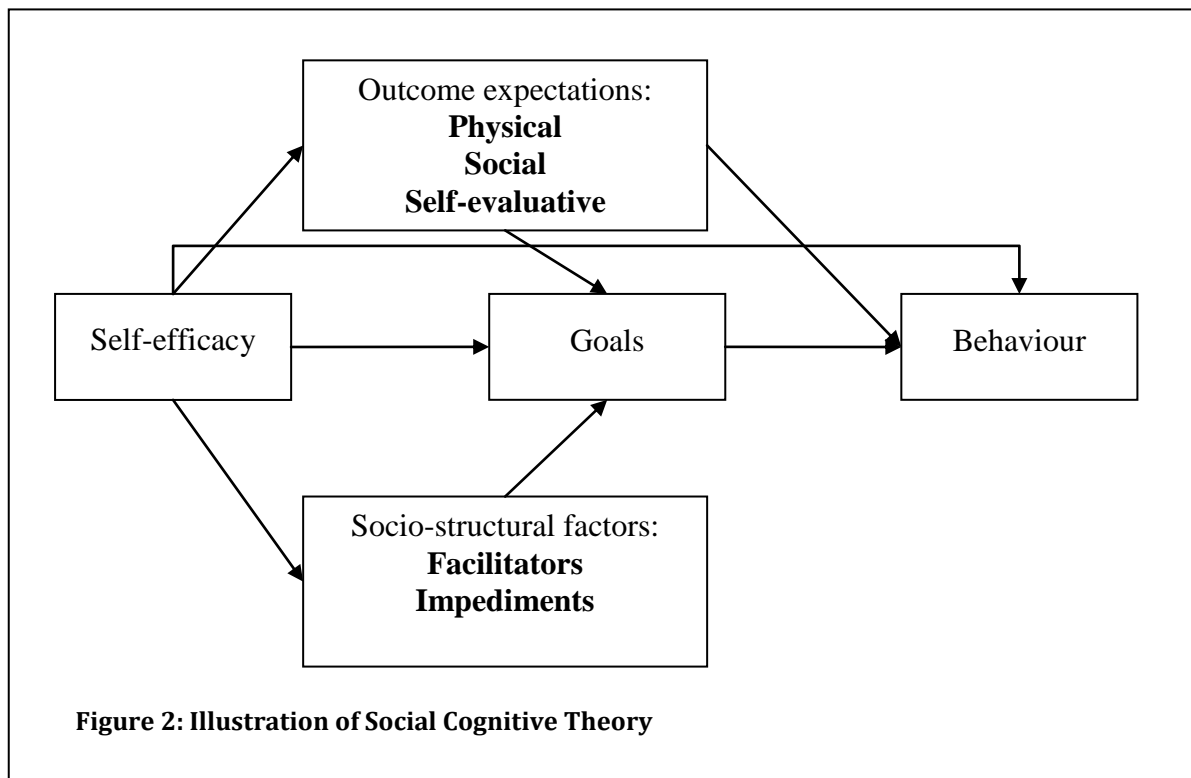
Decision Making Theory

Based on the economic model of cost-benefit analysis, this theory explains that when people decide to engage in a particular behaviour they compare benefits or gains against barriers or losses. This is called “decisional balance”. If benefits (gains) outweigh difficulties (costs), then individuals are more likely to engage in the activity [236: 25-26]. Since these concepts have already been included in previous models, this theory will not be further discussed.

Social Cognitive Theory

Social Cognitive Theory (SCT) was first framed in the 1970s and continued to develop throughout the 1990s to bring a shift of focus from behaviour to cognition (Figure 2). According to this model, “human motivation and action are extensively regulated by forethought” [235: 128]. Mostly used in health promotion, intervention and behavioural changes such as prevention, physical exercise, health risk behaviours and adherence to medication, SCT focuses on the individual’s power to anticipate expected outcomes by taking a particular course of action. This anticipation is greatly affected by the person’s self-efficacy which is the major factor in determining the chance of an action being taken up by the individual. Self-efficacy also has the potential to override socio-cultural barriers.

Therefore a person with strong self efficacy is more likely to take action against existing barriers if they believe the action's outcome will prove positive for them [235: 129-132, 236: 28-29].



[Reprinted with permission from: 235: 129]²

Evaluation and Usefulness of the Model

The concept of self-efficacy has been used by many of the other health behaviour models discussed earlier. However, research shows that it is not always as powerful a predictor as the model asserts it to be [235: 135].

In relation to the present project, the SCT may be used as an exploratory framework to further understand possible differences among various groups of EHS users.

Social Support and Social Networks

The influence of social support, social networks and social relationships on health and illness status and behaviours have been extensively documented [233: 195, 236: 42-43]. While exact mechanisms of such influences and relationships may not be clear at all times, particularly when it comes to health behaviour, reviews show that social interactions and relationships provide an atmosphere within which members receive information, encouragement, reinforcement of ideas or opinions, appraisals, tangible support and companionship. The range of support received can be both positive and negative, and may be provided by different types of networks. The direct and indirect impact of this support on shaping, changing, directing and controlling life-styles, attitudes, expectations,

² Mark Conner & Paul Norman, *Predicting Health Behaviour: Research and Practice with Social Cognition Models*, ©2005, Reproduced with the kind permission of Open University Press. All rights reserved.

experiences, beliefs, traditions, habits and actions makes it a crucial factor in understanding human behaviour.

Social support and social networks are comprised of four major dimensions [233: 189-210]:

- 1) Types of support
- 2) Sources of support
- 3) Characteristics of support
- 4) Functions of support

Types of Support

Information support: provision of advice, suggestions and information.

Emotional support: involves expression of love, empathy, trust and caring.

Instrumental support: includes tangible aid and services.

Esteem support: constructive feedback used in self appraisal.

In addition to the above, which mainly connote positive assistance, some investigators also speak of “negative support” when social networks provide criticism or other forms of unwanted feedback.

Sources of Support

Support can be provided from a variety of sources within an individual’s immediate or distant social network, such as, family, friends, relatives, neighbours, co-workers, club members, health and medical professionals, unions, and religious groups. These sources may have a formal or informal nature and their interactions with individuals may be governed by written or unwritten rules and norms. Also the type and the amount of support provided differ from source to source and depends on the circumstances. For instance, families are more likely to provide extreme emotional and financial support in an emergency situation but health professionals will provide information and service support.

Characteristics of Support

Glanz and colleagues summarise the characteristics of support as – reciprocity, directionality, intensity or strength, complexity, formality, density, homogeneity, and geographic dispersion[233: 191]. Reciprocity is dependent on the power relationships between providers and receivers; on this basis support may be reciprocal or unidirectional. So too, the degree of intensity or strength of relationships determines the extent of emotional support that may be offered. Complexity characterises the numerous supportive functions a relationship may provide. Formal support is often instituted within legal entities and organisations. Density describes the level of familiarity among members of a network, while homogeneity shows the degree of similarity among members in terms of demographic characteristics. Geographic dispersion tests the proximity of support networks and is important in that some groups, such as migrants and refugees, may

experience a larger degree of support from relationships based in their country of origin, rather than from their immediate neighbourhood. This last factor is enhanced by the current age of internet which provides increased access to supportive networks in geographically dispersed locations.

Functions of Support

Support networks and groups can provide resources to their members that help empower them to deal with issues (e.g. “social capital”); influence them to act in certain ways; criticise and undermine them; and/or provide them with general companionship and entertainment. It is to be noted that, in an interaction, what the provider perceives as supportive may not be understood the same way by the receiver even when intentions are good. Therefore misunderstandings and unmet expectations can commonly occur particularly when the parties do not share similar beliefs and values.

Cultural Determinants

Studies on health and illness behaviour, particularly within the biomedical paradigm, tend to focus mainly on behaviours such as compliance with medical prescriptions, vaccination, physical activity, and screening. The previously discussed models also try to use social factors to explain health seeking behaviours. However what needs to be considered, in the long term and within the general population, is that such behaviours and related factors occur within a cultural context where behaviours, beliefs, perceptions, norms and values are created, enforced and reinforced; via interactions with formal and informal settings. This is of particular significance in modern societies today where blends of cultures and policies of multiculturalism promote the coexistence of a wide range of belief systems, values, and behaviours.

People are exposed to various cultural influences via the family, school, work, media, and other agents of acculturation and socialisation; through which “appropriate” ways of thinking, feeling and acting are adopted. These influences create habitual systems of beliefs, and actions, whereby when a person moves to a different group or community they persist in adhering to previous habits and beliefs, at least initially, rather than changing them according to norms and values of the newly adopted host culture. Over time, culture imposes its influence through factors such as education, socio-economic status, employment status, social class, geographic location, ethnicity, immigrant status, language, age and gender. Social networks are mediums of culture which engage members and reinforce social discourse. Interrelationships between cultural factors and individual beliefs and behaviours are complex and often unconscious [237].

Health and illness seeking behaviours are intertwined with these cultural influences. Every culture has its own ways of defining health and illness, expressing pain, and diagnosing and treating illnesses. Certain cultural labels and stigmas are attached to illnesses and formal and informal avenues of care and treatment differ accordingly. What level of care various groups of patients can or should access are sometimes culturally determined. These norms and values are internalised in the form of habits reinforced through social discourses, socialisation processes within the family, school, peer groups, and in the wider community through media attention, laws, and governmental policies [231, 235, 237-239].

Within this context the differential factors of age, gender, religion, ethnic background, and migration status can provide a meaningful interpretation as to how and why social groups differ in their dealings with issues of health and illness seeking behaviours.

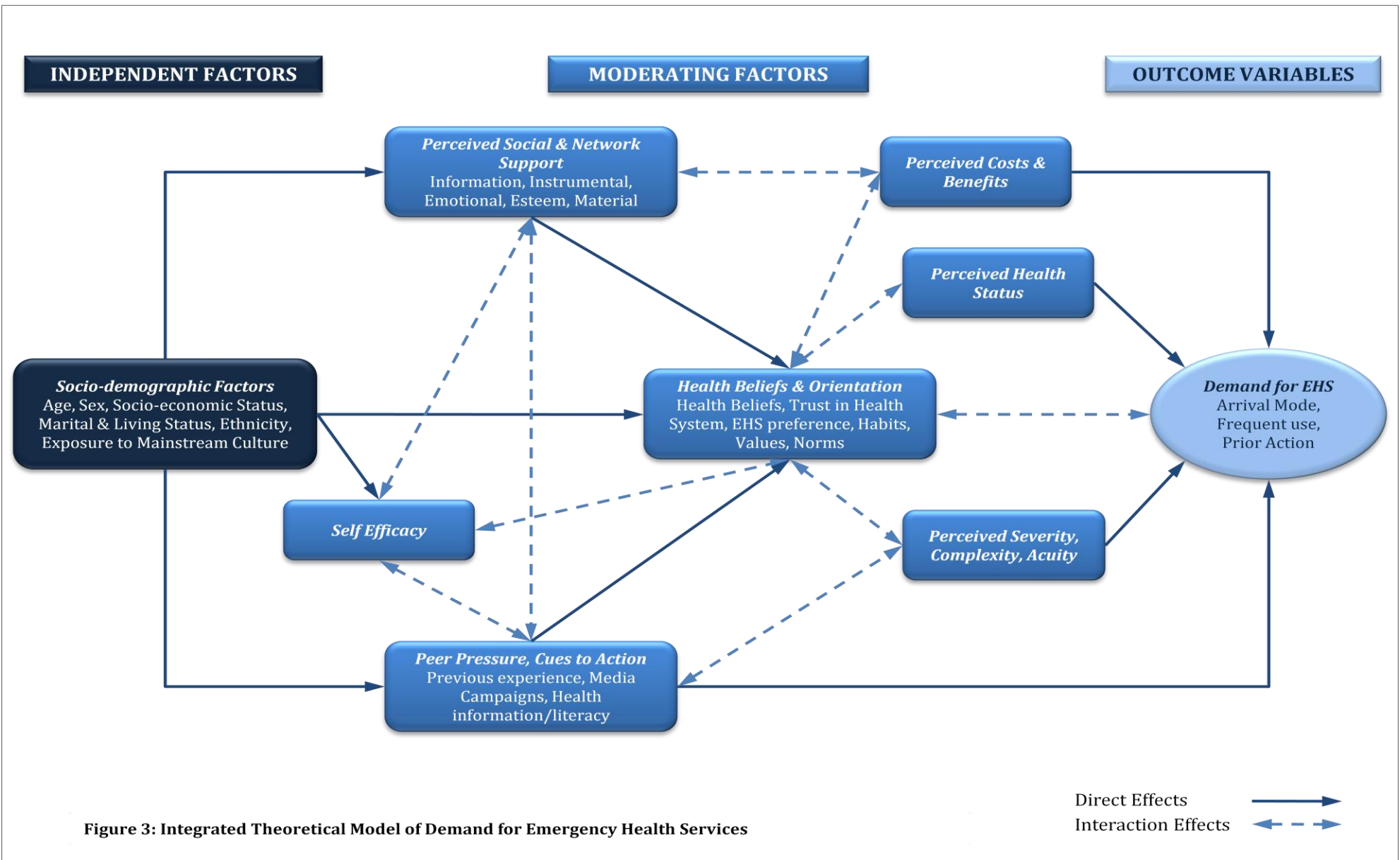
An Integrated Conceptual Model for EHS Demand

To begin with, a summary of the main points and concepts from previous models has been presented in

Table 2: Summary of Health Behaviour Models

Model	Central Theme	Relevant Ideas
Health Belief Model (HBM)	People's decision to act is influenced by their perception of the threat, benefits outweighing barriers, clarity of guidelines, and self-efficacy	Perceived susceptibility Perceived severity of illness Perceived benefits Perceived barriers Cues to action Self-efficacy
Health Services Utilisation Behaviour	Decision to use is influenced by actual or perceived access to health services	Objective access Subjective access
Theory of Planned Behaviour	Action occurs as a function of reasoning and rational choice	Behavioural intention Attitude Normative beliefs Perceived behavioural control
Decision Making Theory	Action is taken if benefits outweigh barriers	Perceived benefits Perceived barriers
Social Cognitive Theory	Personal power and environmental factors influence one another in determining the course of action	Self-efficacy Outcome expectations Direct reinforcement Observational learning
Social Support and Social Networks	Various types of support within communities and networks affect members' beliefs, lifestyles, decisions and actions	Types of support: <ul style="list-style-type: none"> • Information • Emotional • Instrumental • Esteem Sources of support: <ul style="list-style-type: none"> • Formal networks • Informal networks
Cultural Determinants	How cultural factors affect individuals' beliefs and actions regarding health and illness	Gender differences Age differences Religion Ethnicity Migration status

Following that, Figure 3 shows an integrated theoretical model developed from the key concepts and hypothetical relations between the above models. This integrated model is used as a theoretical tool for studying, analysing, and interpreting factors that affect the use of Emergency Health Services within Queensland and Australia; specifically EDs and ambulance services.



In summary, demand for EHS is seen as the dependent variable that can be explained by independent socio-demographic factors which are mediated and modified through an individual's health beliefs and perceptions, personal characteristics, social environment, and illness conditions. As the model illustrates, the immediate factors that can affect a person's decision to seek care are moderated by their perception of the severity, complexity and acuity of the illness, and of their general health status. The decision to pursue a particular course of action is influenced by the immediate, and often spontaneous, analysis of costs and benefits. Therefore if a condition is considered to be worthy of medical attention then the benefits of, and barriers to, performing the action (e.g. seeing a GP or visiting an ED instead) are consequently considered. Benefits and barriers may include financial costs, convenience, access, and availability (perceived or actual) of the health services.

The decision to choose a particular action is a reflection and/or effect of beliefs regarding the health system and learnt norms and values about how to act at times of illness or injury. An individual's decision to access the EHS is based upon personality traits such as self-efficacy and belief in one's abilities of response; previous experience and information regarding treatment at an ED; and environmental factors such as peer pressure and support networks. The influence of these combined factors becomes more diffuse when patients with lower acuity or non-urgent problems seek emergency medical care. For instance, urging by a relative or co-worker to visit an ED or the perception that using an ambulance would provide a higher priority at the ED based on previous experience by the patient or others can be explained by these factors.

Socio-demographic characteristics can alter or determine how people feel, think, learn and behave when accessing EHS. The level of social support, self-efficacy, health beliefs and knowledge of the system are affected by their age, gender, education, income and material resources, living arrangements and ethnic status. An elderly person living alone and without access to transport is more likely to call an ambulance even when they do not perceive their condition to be urgent; or a newly arrived migrant or refugee without a clear and detailed knowledge of the host country's medical system may act in accordance with what they have already learnt and experienced in their country of origin.

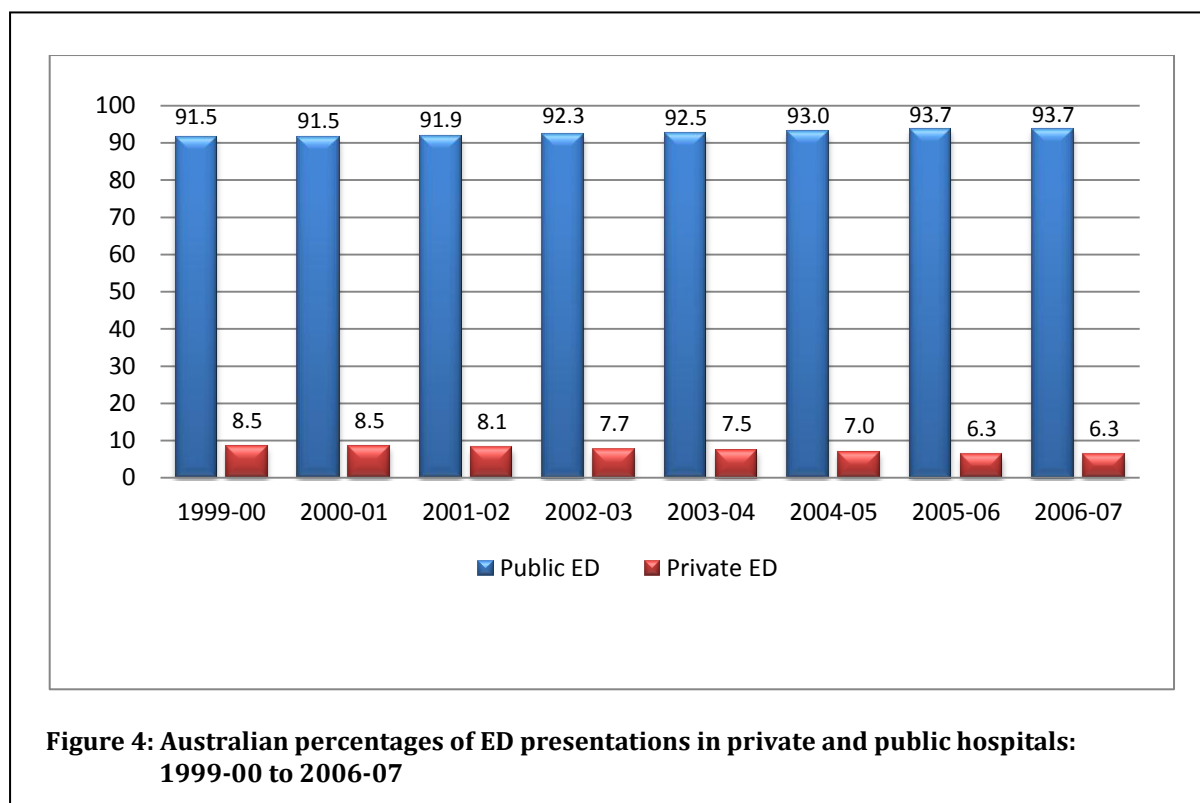
Finally, it is to be noted that the relations among these factors are fundamentally based upon individual subjective experiences and are not necessarily linear and one-way (cause-effect). In many situations new experiences can alter old perceptions and lead to a change of behaviour in the future whereby, for example, a patient leaving the ED after a long wait without being seen by medical staff may alter their decision next time to seek alternative care for a similar condition.

8. Activity Trends

This section shows the trends, patterns, and shifts in the utilisation of ED and ambulance services in Australia with a focus on Queensland. The data for this section have been extracted, compiled, and collated from publicly available sources. Data for ED utilisation were extracted from reports and hospital statistics published by the Australian Institute of Health and Welfare (AIHW) [23, 24, 156, 157, 240-249]. Ambulance data were extracted from annual reports published by the Council of Ambulance Authorities (CAA) [20, 250-258]. Population figures were sourced from census and estimates published by the Australian Bureau of Statistics (ABS) [39, 259-262].

Emergency Departments

Demand for public hospital EDs has consistently increased over the last decade as Figure 4 shows. During the same time frame, private hospital ED presentations decreased from 8.5% to 6.3%.



Due to the unavailability of detailed data regarding private hospitals, this section only deals with public hospital presentations.

Based on Table 3, the total number of patients attending public hospital EDs in 2009-10 (7.3 million) was approximately 45% higher than in 1998-99 (5 million). The largest increase was seen in Tasmania where demand more than doubled during this period with a total growth of 184%. Western Australia (16.8%) and the Northern Territory (22.5%) recorded the lowest total growth percentages. In 2009-10, Queensland EDs were attended by over 1.5 million patients; 61% more than the number of visits in 1998-99. In terms of the number of ED presentations, Queensland compares closely with Victoria, however Queensland is less populated. Therefore it is important to examine ED presentations as adjusted by population, or utilisation, rates.

Table 3: Total No. of ED occasions of service in Australian public hospitals, 1998-99 to 2009-10

Year	Unit	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
1998-99	'000	1 443	1 102	1 137	607	461	71	83	106	5 010
1999-00	'000	1 609	1 118	1 147	611	463	92	85	96	5 220
2000-01	'000	1 771	1 144	1 168	566	476	92	93	97	5 407
2001-02	'000	2 003	1 210	1 220	561	469	101	95	95	5 755
2002-03	'000	1 982	1 261	1 223	571	472	97	96	94	5 796
2003-04	'000	1 986	1 289	1 248	580	461	101	97	102	5 864
2004-05	'000	2 007	1 318	1 282	593	474	122	94	104	5 993
2005-06	'000	2 137	1 409	1 304	629	496	134	100	120	6 328
2006-07	'000	2 304	1 468	1 382	727	516	125	96	123	6 741
2007-08	'000	2 418	1 523	1 471	778	544	143	98	125	7 101
2008-09	'000	2 417	1 538	1 525	783	532	146	102	129	7 172
2009-10	'000	2 443	1 592	1 578	823	555	159	107	133	7 390
Annual growth (%)		3.4	2.9	3.8	1.4	1.9	8.9	2.8	1.7	3.0
Total growth (%)		50.1	45.0	61.2	16.8	27.9	184.3	42.1	22.5	45.4

Source: [23, 24, 156, 157, 240-249]

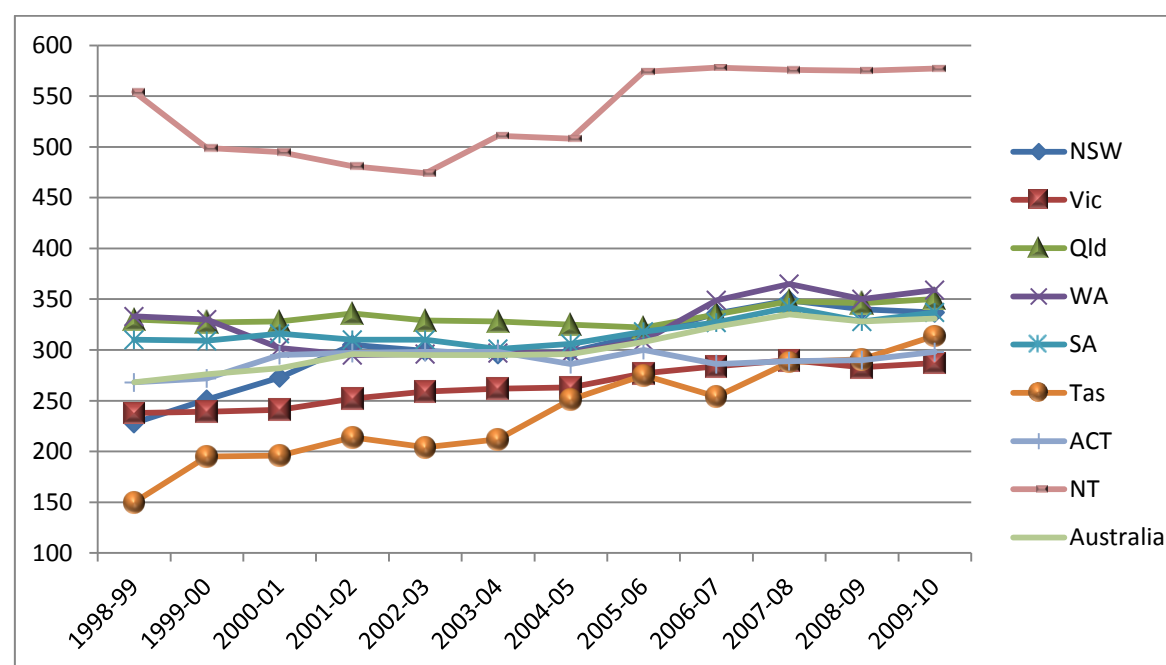
Table 4 shows the number of ED occasions of service per 1000 persons in Australia; this is also referred to as ED presentation rate or utilisation rate. During the period of 1998-2010 the utilisation rate was highest in the Northern Territory (NT), this may be explained by the Northern Territory's smaller and more dispersed population, availability of alternative services and a high concentration of indigenous population. That aside, Queensland (Qld) has shown the highest utilisation rates of all states seven out of the twelve years reported; ranging from 330 in 1998-99 to 350 in 2009-10. Western Australia (WA) and South Australia (SA) closely follow suit. Tasmania (Tas) and Victoria (Vic) show the lowest ED presentation rates in the country.

Table 4: ED occasions of service per 1000 persons in Australia, 1998-99 to 2009-10

Year	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
1998-99	228	238	330	333	310	150	268	554	268
1999-00	251	239	327	330	309	195	272	499	276
2000-01	273	241	328	302	316	196	295	495	282
2001-02	305	252	336	295	310	214	297	481	296
2002-03	299	259	329	296	310	204	298	474	295
2003-04	296	262	328	297	301	212	298	511	295
2004-05	298	263	325	297	306	251	286	508	296
2005-06	315	277	322	309	318	275	300	574	308
2006-07	336	284	335	349	327	254	286	578	323
2007-08	349	290	348	365	342	288	289	576	335
2008-09	340	283	346	350	328	291	290	575	328
2009-10	337	287	350	359	337	314	298	577	331
Average Rate	302	265	334	324	318	237	290	534	303
(95% Confidence Interval)	(282-322)	(254-275)	(329-339)	(309-338)	(311-325)	(210-264)	(284-295)	(511-556)	(291-315)
Annual growth (%)	3.7	1.7	0.6	0.8	0.8	7.4	1.0	0.5	2.0
Total growth (%)	47.8	20.6	6.1	7.8	8.7	109.3	11.2	4.2	23.5
Population growth (%)	1.0	1.2	2.1	1.6	0.7	0.4	0.9	1.5	1.3

Source: [23, 24, 156, 157, 181, 240-249]

Overall, the utilisation of ED treatment grew 2% per annum across Australia between 1998-99 and 2009-10. In comparison, Figure 5 graphs the utilisation rates across Australia during the same period. As can be seen, some years show a slowing of the growth rate. The magnitude of growth of presentation rates slowed, in most parts of the country, between 2001-02 and 2004-05.

**Figure 5: ED occasions of service per 1000 persons in Australia: 1998-99 to 2009-10**

Source: [23, 24, 156, 157, 181, 240-249]

It is noteworthy that the speed of growth does not necessarily match the utilisation rates amongst states and territories. For example, Tasmania which recorded one of the lowest average utilisation rates (237) during 1998-2010, also recorded the highest annual growth (7.4%). Meanwhile Queensland with one of the highest average utilisation rates (334) recorded a comparatively low annual growth (0.6). Consequently, while Queensland has historically had the highest ED presentation rates among the major states, the rest of Australia appears to be closing the gap with Queensland's utilisation rate

ED Type and Location

Australian Institute of Health and Welfare classifies hospitals into four major peer groups: Principal Referral and Specialist Women's and Children's hospitals; Large hospitals; Medium hospitals; and Small acute hospitals. "Public hospital peer groups have been developed for presenting data on costs per casemix adjusted separation. The peer group classification allocates hospitals into broadly similar groups in terms of their level of admitted patient activity and their geographical location. The classification allows more meaningful comparison of cost data than comparison at the jurisdiction level would allow" [24: 48].

Table 5 demonstrates the distribution of ED caseloads across Australian states and territories between 2003-04 and 2009-10 according to the hospitals' peer group status. Overall, it appears that Principal Referral Hospitals receive more of the ED attendances than they did in the past (67% in 2009-10 compared to 58% in 2003-04). These statistics are reflected across the states and territories. Where reports are available, an upward shift is observed in the use of Principal Referral Hospitals, while all other peer grouped hospitals' patient presentations have decreased in both actual numbers and in percentages.

Compared to the other states, Queensland (73%) and the NT's (73%) Principal Referral Hospitals received the largest percentage of ED patients in Australia during 2003-04. In 2009-10, the proportion of patients seen in Principal Referral EDs increased in all jurisdictions except Victoria, while simultaneously attendance at Large hospitals decreased. The data however needs to be treated cautiously as it only applies to reporting hospitals and the number of reporting hospitals changes from one year to another.

Table 5: Distribution of ED attendances by hospital peer grouping: 2003-04 and 2009-10¹

2003-04	<i>NSW</i>	<i>Vic</i>	<i>Qld</i>	<i>WA</i>	<i>SA</i>	<i>NT</i>	Total²
Principal (%)	48.4	71.1	73.2	31.6	73.2	73.3	58.7
Large (%)	38.0	22.0	26.8	16.2	14.0	na	26.8
All other (%)	13.6	6.9	0.0	52.1	12.8	26.7	14.4
Total (no.)	1,433,674	1,043,992	763,378	579,746	302,938	94,102	4,390,591
2009-10	<i>NSW</i>	<i>Vic</i>	<i>Qld</i>	<i>WA</i>	<i>SA</i>	<i>NT</i>	Total²
Principal (%)	62.4	68.1	78.2	56.0	76.4	73.5	67.5
Large (%)	20.8	24.9	13.3	22.5	11.0	0.0	19.4
All other (%)	16.8	7.0	8.5	21.4	12.6	26.5	13.1
Total (no.)	2,035,783	1,432,745	1,134,092	600,613	373,700	132,583	5,709,516

¹ Only reporting hospitals² Excludes the ACT and Tasmania for not having full data published for both years. Source: [156, 248]

Utilisation rates were much higher in regional and remote areas than in major metropolitan areas (Table 6). Overall, people in regional areas were 1.7 times more likely to use EDs than in major cities. Also, remotely located populations used EDs 3.3 times more than the major city residents. In 2007-2008, Queensland's utilisation rate varied from 231 in major cities, to 512 in regional areas and 958 in remote areas. Queensland's utilisation rate in major cities was lower than other jurisdictions. However, total regional utilisation rate in Queensland (512) was higher than Victoria (394), SA (353) and Tasmania (286). New South Wales (1133) and WA (1089) reported the highest ED utilisation rates for remote areas.

Table 6: ED occasions of service per 1000 persons by hospital remoteness¹: 2001-02 and 2007-08

2001-02	<i>NSW</i>	<i>Vic²</i>	<i>Qld</i>	<i>WA</i>	<i>SA</i>	<i>Tas</i>	<i>ACT</i>	<i>NT</i>	Australia
Major Cities	238	223	241	194	290	n.ap.	297	n.ap.	236
Inner Regional	453	313	380	199	260	216	n.ap.	n.ap.	359
Outer Regional	470	409	411	547	390	175	n.ap.	346	413
Total Regional	458	332	393	354	324	202	na	346	377
Remote	845	n.av.	855	1010	531	761	n.ap.	1,003	853
Very Remote	1871	n.ap.	1160	1228	812	560	n.ap.	333	933
Total Remote	1019	na	966	1087	600	713	na	642	881
Grand Total	305	252	336	295	310	214	297	482	296
2007-08									
Major Cities	282	265	231	267	330	n.ap.	295	n.ap.	271
Inner Regional	531	380	464	397	279	244	n.ap.	n.ap.	436
Outer Regional	550	450	581	680	430	368	n.ap.	488	530
Total Regional	536	394	512	517	353	286	na	488	466
Remote	957	n.av.	922	992	574	527	n.ap.	1,065	893
Very Remote	2359	n.ap.	1273	1,273	904	620	n.ap.	406	937
Total Remote	1133	na	958	1089	649	550	na	724	908
Grand Total	355	297	360	378	347	291	295	595	343

1) The ratio of services provided in the area to the number of residents in the area only approximates population use because services provided in an area may be provided to persons residing in other remoteness area categories.

2) 2) In Victoria, it is not possible to separately identify emergency occasions of service in hospital campuses located in remote areas.

Source: [183, 263]

Figure 6 shows the extent of change in utilisation of EDs by geographic locations between 2001-02 and 2007-08 (data for years after this is not publicly available). Nationally, ED occasions of service per 1000 persons increased by 15% in major cities, 24% in regional areas, and 3% in remote areas. WA had the highest growth in major cities ED utilisation rates, followed by Victoria and NSW. Queensland and the ACT showed a decline in this respect. In regional areas, WA, Tasmania, and NT had the highest growths of over 40%; Queensland had a 30% increase followed by Victoria and NSW. South Australia, with 9%, experienced the lowest increase. In remote areas, the utilisation rate increased in NT, NSW and SA, while it decreased dramatically in Tasmania and less so in Queensland.

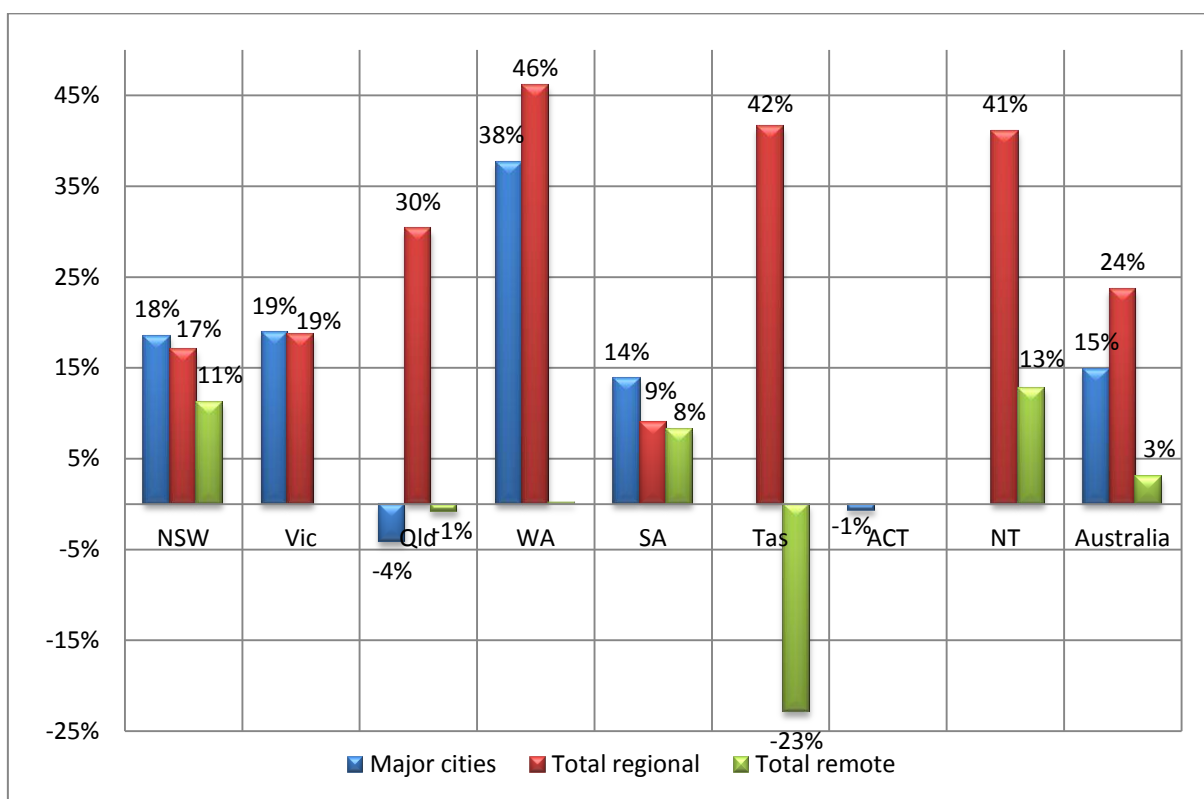


Figure 6: Australian growth rate in ED occasions of service per 1000 persons by ED remoteness between 2001-02 and 2007-08

Source: [183, 263]

Triage Category and Demand

Patients presenting to hospital EDs are categorised according to the Australasian Triage Scale (ATS) into five categories of urgency. Table 7 shows the percentage distribution of ED presentations in reporting hospitals across Australia for the two periods of 2003-04 and 2009-10. Nationally, the percentage of category 1 (Resuscitation) patients reduced from 0.8% to 0.7%, while Category 2 (Emergency) and 3 (Urgent) cases increased by about 1.5% and 1.8% respectively. Categories 4 (Semi-urgent) and 5 (Non-urgent) decreased by 1.1% and 2.1% respectively. While the overall trend looks similar across the states and territories, marginal differences are observed. For instance, the percentage of higher acuity patients (ATS 1-2) increased in Queensland, WA, and SA between the two periods, while it decreased in other states. At the same time, the percentage of ATS 4-5 patients decreased in most states. One reason for such shifts may be due to the varying number of public hospital EDs that report episode-level data from year to year.

Table 7: Percentage of ED occasions of service¹ by triage category: 2003-04 and 2009-10

	<i>NSW</i>	<i>Vic</i>	<i>Qld</i>	<i>WA</i>	<i>SA</i>	<i>Tas</i>	<i>ACT</i>	<i>NT</i>	Australia
2003-04									
Resuscitation	0.8	0.7	0.6	0.6	1.1	0.9	1.2	1.0	0.8
Emergency	7.6	7.5	7.4	6.5	10.9	8.8	7.5	5.8	7.6
Urgent	32.9	28.4	34.7	21.5	34.3	35.7	23.9	27.2	30.5
Semi-urgent	44.6	47.7	47.8	45.0	47.9	47.4	42.1	52.6	46.3
Non-urgent	14.0	15.7	9.5	26.4	5.7	7.3	25.4	13.5	14.8
Total (no.)²	1,433,674	1,043,992	763,378	579,746	302,938	81,256	91,547	94,102	4,390,591
2009-10									
Resuscitation	0.6	0.6	0.8	0.8	1.2	0.6	0.5	0.6	0.7
Emergency	8.2	8.5	10.0	11.0	11.5	7.6	9.2	7.0	9.1
Urgent	29.7	30.0	39.7	30.9	35.9	34.4	31.2	27.6	32.3
Semi-urgent	44.4	46.7	41.5	49.9	43.7	46.6	45.7	53.1	45.2
Non-urgent	16.9	14.0	7.9	7.3	7.8	10.8	13.4	11.8	12.7
Total (no.)²	2,035,783	1,432,745	1,134,092	600,613	373,700	141,360	106,814	132,583	5,957,690

(1) Based on episode-level data provided by varying number of reporting hospitals in Peer Groups A and B.

(2) Totals include records for which the triage category was not assigned or not reported.

Source: [156, 248]

The raw number of patients by triage category (data not presented here for brevity) shows that between 2003-04 and 2009-10 the growth in demand for ED care happened in all triage categories nationally, but more so in the ATS 1-2 categories (24% and 62% respectively). However, due to the varying number of reporting hospitals between the two periods, the figures and consequently related calculations are not comparable. While it is likely that these changes could be due to reclassification of patients, we compared the percentage of admitted patients and arrivals by ambulance between the two periods as proxy indicators of change in the acuity of patients' conditions. As Table 8 demonstrates there are now more patients admitted in higher acuity triage categories than they were a decade earlier, while the likelihood of admission for lower acuity patients has decreased. There is little change in the likelihood of arrival by ambulance according to triage category.

Table 8: Change in percentage admitted and ambulance arrivals by triage category in Australia

Triage category	Admitted		Arrived by Ambulance	
	2000-01	2009-10	2003-04	2009-10
Resuscitation	79.0	84.3	84.8	85.0
Emergency	63.0	64.3	49.2	47.6
Urgent	43.0	42.4	33.0	34.0
Semi-urgent	18.0	16.6	15.3	15.5
Non-Urgent	8.0	5.0	3.7	4.2
Total	28.0	28.3	22.1	23.5

Sources: Admitted data: 2000-01 [244: Table 4.11]; 2009-10 [248: Table S5.8]

Ambulance arrival data: 2003-04 [156: Table 5.8]; 2009-10 [248: Table S5.4]

Ambulance Services

There is evidence that demand for ambulance services is rising in Australia as in many western countries [27, 28, 158, 189, 190, 264-266]. In England, use of ambulance has been rising since 1997-98 with calls to 999 emergency telephone line increasing at an average rate of 6.5% per year [27].

In Australia, reporting of ambulance utilisation is complicated and significantly varies from one source of data to another, due to some extent to the definitions of incidents, responses, patients and transports by various service providers across jurisdictions [for example compare: 25(Table 9A.23), 189, 264]. In Australian states and territories, calls for ambulance service are evaluated and assigned an urgency status, most commonly using a pre-determined algorithm (Advanced Medical Priority Dispatch). Thus all responses are categorised as Emergency (Code 1), Urgent (Code 2) or Non-urgent (Codes 3 or 4). Ambulance crews respond to the first category utilising audible and visual warning devices (lights and sirens), but are dispatched as soon as practical to the second category without sirens. Non-urgent patients usually receive pre-booked and scheduled responses. This system has been modified over many years and definitions and categories between states and territories do not always match. For instance Queensland also has a Casualty Room Attendance category which is not currently used in other states/territories, and NSW does not differentiate between Emergency and Urgent.

In the context of the data used for this study, the “Urgent” (Code 1-2) cases are the patients that self-access the emergency service via Triple Zero emergency telephone line (i.e. they have not been pre-triaged by a doctor). This group may contain patients who may not require an ambulance but the system does not have the means to identify/triage them over the phone. ‘Non-urgent’ (Code 3-4) cases are those that have already been seen and triaged by a doctor (i.e. medically authorised transports, hospital transfers).

Demands for ambulance services are also defined either as **incidents** (separate events), **patients** transported or treated, and ambulance **responses**. Thus to any single incident, a service may respond one or more ambulances, and paramedics may treat and transport none, one or more patients [158: 343]. There are differences between states and territories in defining these categories. For example, incidents and responses are not separated in Northern Territory and both are reported as ambulance caseload, which closely match responses in other jurisdictions. The rest of this section reports the trends in ambulance usage in Queensland compared to the rest of Australia.

Ambulance Incidents, Responses and Patients

The gross demand for ambulance services has been increasing in Australia over the past decade (Table 9 to 11). In 2009-10, a total of over 3 million incidents were responded by ambulance paramedics in Australia which showed a total growth of about 67% compared to 1999-00 and an average increase of 5.3% per annum since 1999-00 (Table 9). South Australia recorded the highest annual growth rate of 7.8% followed by the ACT (6.8%) and Qld and Tasmania (5.8% each). New South Wales had the lowest growth rate of 3.8%.

Table 9: Gross number of ambulance incidents in Australia: 1999-00 to 2009-10

Year	<i>Unit</i>	<i>NSW</i>	<i>Vic</i>	<i>Qld</i>	<i>WA</i>	<i>SA</i>	<i>Tas</i>	<i>ACT</i>	Australia¹
1999-00	'000	649	451	430	137	129	41	19	1 796
2000-01	'000	709	479	460	138	167	40	21	2 013
2001-02	'000	740	512	515	145	173	43	23	2 151
2002-03	'000	768	558	510	118	176	44	25	2 225
2003-04	'000	787	563	566	144	184	53	25	2 322
2004-05	'000	794	578	593	150	189	49	23	2 375
2005-06	'000	834	631	636	156	206	59	27	2 549
2006-07	'000	880	674	682	166	220	61	29	2 713
2007-08	'000	932	702	733	174	236	61	32	2 870
2008-09	'000	939	714	751	188	246	63	33	2 934
2009-10	'000	941	742	750	199	268	70	36	3 005
Annual growth²	%	3.8	5.1	5.8	4.3	7.8	5.8	6.8	5.3
Total growth³	%	45.0	64.5	74.4	45.3	107.8	70.7	89.5	67.3

¹ Data excludes NT. ² Average annual growth from 1999-00 to 2009-10. ³ Based on growth in 2008-09 compared to 1999-00.

Source: 1999-00: [267: Table 11A.17]; 2000-01: [250: P. 70]; 2001-02: [268: 61]; 2002-03 & 2003-04: [269: Table 8A.20]; 2004-05 to 2008-09: [25: Table 9A.23]; 2009-10: [258: p. 63]

Table 10 shows the number of ambulance responses between 2001-02 and 2009-10. Due to data anomalies data reported for previous years were excluded from analysis. In 2009-10 Ambulance services provided over 3.5 million responses to incidents across Australia. This presents a total increase of nearly 44% and an annual growth of 4.6% since 2001-02. South Australia recorded the highest increase of approximately 70% during this period with an annual increase of about 7% followed by Tasmania (5.5%) and Queensland (5.3%). NSW with 3.5% had the slowest annual growth. Other States and the ACT hovered around the national average.

Table 10: Gross number of ambulance responses in Australia: 2001-02 to 2009-10

Year	<i>Unit</i>	<i>NSW</i>	<i>Vic</i>	<i>Qld</i>	<i>WA</i>	<i>SA</i>	<i>Tas</i>	<i>ACT</i>	<i>NT</i>	Australia
2001-02	'000	859	616	558	145	181	48	25	27	2 459
2002-03	'000	896	670	572	136	185	51	27	26	2 563
2003-04	'000	928	675	648	145	195	51	27	26	2 695
2004-05	'000	947	694	677	153	201	56	27	31	2 785
2005-06	'000	999	752	732	159	215	62	30	31	2 980
2006-07	'000	1 053	805	797	171	232	63	32	34	3 188
2007-08	'000	1 119	831	858	180	252	63	34	35	3 371
2008-09	'000	1 120	864	829	196	272	65	34	37	3 418
2009-10	'000	1 133	900	838	206	307	73	36	38	3 530
Annual growth	%	3.5	4.9	5.3	4.6	6.9	5.5	4.7	4.6	4.6
Total growth¹	%	31.9	46.1	50.2	42.1	69.6	52.1	44.0	40.7	43.6

¹ Based on growth in 2009-10 compared to 2001-02 Source: 2000-01: [250: P. 70]; 2001-02: [268: 61]; 2002-03 & 2003-04: [269: Table 8A.20]; 2004-05 to 2008-09: [25: Table 9A.23]; 2009-10: [258: p. 63]

The gross number of patients attended (treated or transported) is demonstrated in Table 11. In 2009-10 a total of 2.8 million patients were attended by ambulance personnel, up by 4.2%

annually since 2001-02. Tasmania with 5.7% had the fastest growth, ahead of NT and WA each with about 5% increase. The ACT and SA (3%) recorded the lowest growth rates.

Table 11: Gross number of ambulance patients in Australia: 2001-02 to 2009-10¹

Year	<i>Unit</i>	<i>NSW</i>	<i>Vic</i>	<i>Qld</i>	<i>WA</i>	<i>SA</i>	<i>Tas</i>	<i>ACT</i>	<i>NT</i>	Australia
2001-02	'000	676	471	478	142	181	42	25	23	2 037
2002-03	'000	737	509	491	138	185	42	25	23	2 150
2003-04	'000	734	515	520	147	177	33	27	23	2 176
2004-05	'000	763	534	548	154	181	41	23	26	2 271
2005-06	'000	801	584	601	161	188	46	25	27	2 433
2006-07	'000	889	623	621	174	202	49	27	29	2 614
2007-08	'000	860	648	651	182	216	50	27	30	2 663
2008-09	'000	884	656	658	196	220	50	28	33	2 725
2009-10	'000	892	683	683	207	229	61	31	34	2 817
Annual growth²	%	3.6	4.8	4.6	4.9	3.0	5.7	3.0	5.1	4.2
Total growth³	%	32.0	45.0	42.9	45.8	26.5	45.2	24.0	47.8	38.3

¹Patients data are not available prior to 2001.² Average annual growth from 2001-02 to 2009-10.³ Based on growth in 2009-10 compared to 2001-02. Source: 1999-00: [267: Table 11A.17]; 2000-01: [250: P. 70]; 2001-02: [268: 61]; 2002-03 & 2003-04: [269: Table 8A.20]; 2004-05 to 2008-09: [25: Table 9A.23] ; 2009-10: [258: p. 63]

Incident: Response: Patient Ratio

In 2001-02 the incident: response: patient ratio for Australia was 100:114:95, meaning that for each incident, on average, at least one additional vehicle were dispatched 14% of the time, but less than one patient was treated or transferred. Some incidents had no patients. This ratio changed to 100:117:94 in 2009-10. The ratio for Queensland was 100:108:93 in 2001-02 and changed to 100:112:91 in recent years. In comparison, Queensland dispatches fewer vehicles and attends fewer patients per incident than Victoria (100:121:92) and NSW (100:120:95) but is close to other jurisdictions.

Population Adjustment

The growth in demand reflects population growth to some extent; however even after taking population growth into account, there has been an increase in per capita demand. This is described as the “utilisation rate” which is the number of incidents per 1000 population, or the percent of the population that uses the ambulance service each year. The average utilisation rate across Australia for ambulance was 120 (95% CI= 114-127) in the decade ending 2009-10 (Table 12). Queensland had the highest utilisation rate of 152 (95% CI= 142-161) during this period, well ahead of SA (128; 95% CI=115-141) and NSW (120; 95% CI= 114-127). Western Australia (77; 95% CI= 73-81) and the ACT (80; 95% CI= 73-88) had the lowest average number of incidents per 1000 persons in the country during the study period.

Nationally, ambulance services responded to 137 incidents per 1000 population in 2009-10. This is a total increase of about 43% compared to 1999-00, or an average increase of 3.7% per annum. Queensland recorded a 4.4% annual increase ahead of all states except Tasmania and the ACT. Western Australia (2.1%) and NSW (3%) had the slowest overall growth rates.

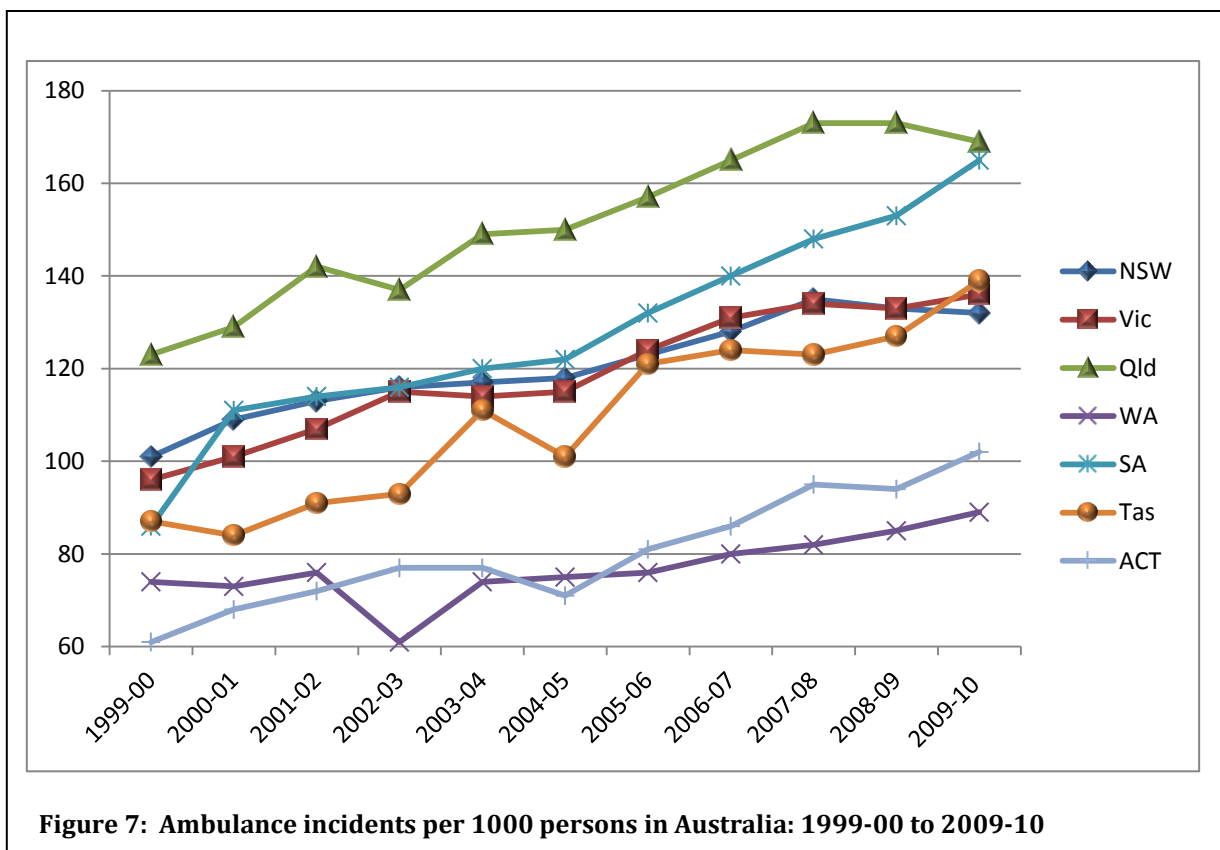
Table 12: Ambulance incidents per 1000 persons in Australia: 1999-00 to 2009-10

Year	NSW	Vic	Qld	WA	SA	Tas	ACT	Australia ¹
1999-00	101	96	123	74	86	87	61	95
2000-01	109	101	129	73	111	84	68	105
2001-02	113	107	142	76	114	91	72	111
2002-03	116	115	137	61	116	93	77	113
2003-04	117	114	149	74	120	111	77	117
2004-05	118	115	150	75	122	101	71	117
2005-06	123	124	157	76	132	121	81	124
2006-07	128	131	165	80	140	124	86	130
2007-08	135	134	173	82	148	123	95	136
2008-09	133	133	173	85	153	127	94	136
2009-10	132	136	169	89	165	139	102	137
Mean No. of Incidents	120	119	152	77	128	109	80	120
(95% Confidence Interval)	(114-127)	(111-127)	(142-161)	(73-81)	(115-141)	(99-120)	(73-88)	(114-127)
Annual growth (%)²	3.0	4.1	4.4	2.1	4.3	6.0	5.3	3.7
Total growth (%)³	31.8	38.4	40.6	15.0	77.2	46.0	53.1	42.9
Population growth (%)²	1.0	1.2	2.1	1.6	0.7	0.4	0.9	1.3

¹ Data excludes NT. ² Average annual growth from 1999-00 to 2009-10. ³ Based on growth in 2009-10 compared to 1999-00.

Source: 1999-00: [267: Table 11A.17]; 2000-01: [250: P. 70]; 2001-02: [268: 61]; 2002-03 & 2003-04: [269: Table 8A.20]; 2004-05 to 2008-09: [25: Table 9A.23]; 2009-10: [258: p. 63]; Population growth: [262]

As Figure 7 illustrates, while Queensland leads the other jurisdictions in terms of the utilisation rate for ambulance services, all other major states are rapidly closing the gap. Western Australia and the ACT have maintained steady utilisation rates and still have far fewer incidents than the rest of the country.



Urgent versus Non-urgent Priority Incidents

Figure 8 demonstrates that demand for ambulance has been much higher in urgent (including emergent and urgent) incidents than non-urgent ones. Table 13 shows that on average, 79 (95% CI= 73-84) urgent incidents per 1000 population were attended by ambulance paramedics in Australia in the past decade. Urgent cases increased steadily at a rate of 3.7% annually from 63 in 1999-00 to 90 in 2009-10, an increase in total of just less than 43% (Table 13). In the same period, an average 42 (95% CI= 40-45) non-urgent incidents were responded to. These incidents increased by 3.8% annually from 33 in 1999-00 to 47 in 2009-10 showing a total growth of 42.4% (Table 13).

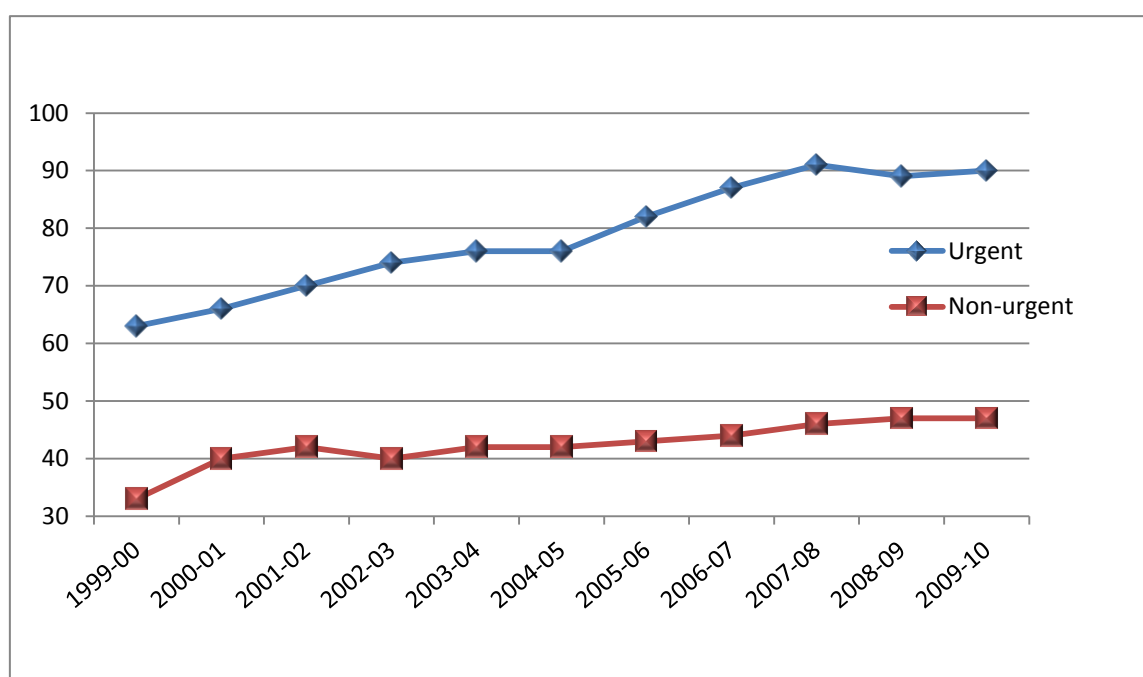


Figure 8: Urgent and non-urgent incidents per 1000 persons in Australia: 1999-00 to 2009-10

The utilisation rate has not been the same across Australia (Table 13). Queensland with an average of 98 (95% CI=89-108) incidents per 1000 population had the highest number of urgent incidents in the past decade, followed by SA (91; 95% CI= 83-100) and Tasmania (89; 95% CI= 80-98). Western Australia (42; 95% CI= 40-43) had the lowest rate. In terms of annual growth, Queensland with 5% was the third highest after SA (7.3%) and the ACT (6.1%). Western Australia had the lowest growth in the number of urgent incidents per 1000 population throughout the decade at an average 1.9% per annum.

Regarding non-urgent incidents, with an average of 51 cases per 1000 population, Queensland (95% CI= 49-53) and Victoria (95% CI= 47-55) led other states/territories in the past decade, followed by NSW (37; 95% CI= 35-39), SA (36; 95% CI= 32-41) and WA (35; 95% CI= 32-38). However, the pace of growth in non-urgent incidents has been the lowest

for Queensland (1.1% per annum). The ACT had the second lowest rate at 3.5%. The highest growth rate in non-urgent incidents belonged to Tasmania (7.9%) and SA (6.5%).

Table 13: No. of incidents per 1000 persons by urgency dispatch category: 1999-00 to 2009-10

Year	<i>NSW</i>	<i>Vic</i>	<i>Qld</i>	<i>WA</i>	<i>SA</i>	<i>Tas</i>	<i>ACT</i>	Australia¹
<i>Urgent</i>								
1999-00	76	59	72	40	57	74	48	63
2000-01	71	58	75	38	77	69	52	66
2001-02	75	61	84	41	82	73	56	70
2002-03	76	65	91	40	87	73	61	74
2003-04	77	66	96	42	89	88	60	76
2004-05	78	67	99	41	90	83	56	76
2005-06	87	70	104	41	99	97	65	82
2006-07	93	75	111	41	102	100	67	87
2007-08	98	74	119	42	105	103	73	91
2008-09	96	73	115	44	106	107	74	89
2009-10	93	77	117	48	111	115	85	90
Mean No. of Incidents	84	68	98	42	91	89	63	79
<i>(95% Confidence Interval)</i>	<i>(78-89)</i>	<i>(64-71)</i>	<i>(89-108)</i>	<i>(40-43)</i>	<i>(83-100)</i>	<i>(80-98)</i>	<i>(57-69)</i>	<i>(73-84)</i>
Annual growth² (%)	2.2	2.8	5.0	1.9	7.3	4.8	6.1	3.7
Total Growth³ (%)	22.4	30.5	62.5	20.0	94.7	55.4	77.1	42.9
<i>Non-urgent</i>								
1999-00	26	38	48	33	29	13	13	33
2000-01	38	44	49	35	33	15	15	40
2001-02	38	46	55	35	32	18	16	42
2002-03	40	50	46	21	29	20	17	40
2003-04	41	48	50	31	31	23	17	42
2004-05	40	48	50	34	32	18	15	42
2005-06	36	54	51	35	33	25	16	43
2006-07	36	55	51	39	38	23	20	44
2007-08	37	60	52	40	43	19	23	46
2008-09	38	60	56	41	47	20	20	47
2009-10	39	59	52	40	53	24	17	47
Mean No. of Incidents	37	51	51	35	36	20	17	42
<i>(95% Confidence Interval)</i>	<i>(35-39)</i>	<i>(47-55)</i>	<i>(49-53)</i>	<i>(32-38)</i>	<i>(32-41)</i>	<i>(18-22)</i>	<i>(16-19)</i>	<i>(40-45)</i>
Annual growth² (%)	5.0	4.7	1.1	4.0	6.5	7.9	3.5	3.8
Total Growth³ (%)	50.0	55.3	8.3	21.2	82.8	84.6	30.8	42.4

¹ Data excludes NT. ² Average annual growth from 1999-00 to 2009-10.

³ Based on growth in 2009-10 compared to 1999-00.

Underlying Health System Issues

The reasons behind the changes in demand for ED and ambulance services were stipulated in the previous sections and the relevant literature and their shortcomings were discussed. In addition, underlying health issues and policies have been frequently cited as causing pressure and creating demand for emergency health services. Availability of other primary

care sources, particularly general practitioners (GPs) and the number of hospital beds are two of these factors.

As Figure 9 demonstrates the number of full-time equivalent (FTE) GPs decreased from 77 GPs per 100,000 persons in 1996-97 to 71.5 in 2003-04, a total reduction of 6.2% or annual average fall of 0.2%. The trend appears to be changing with an increased intake of overseas trained medical graduates in recent years. However, despite the gradual increase in the number of GPs, the demand for ED and ambulance does not show any reduction.

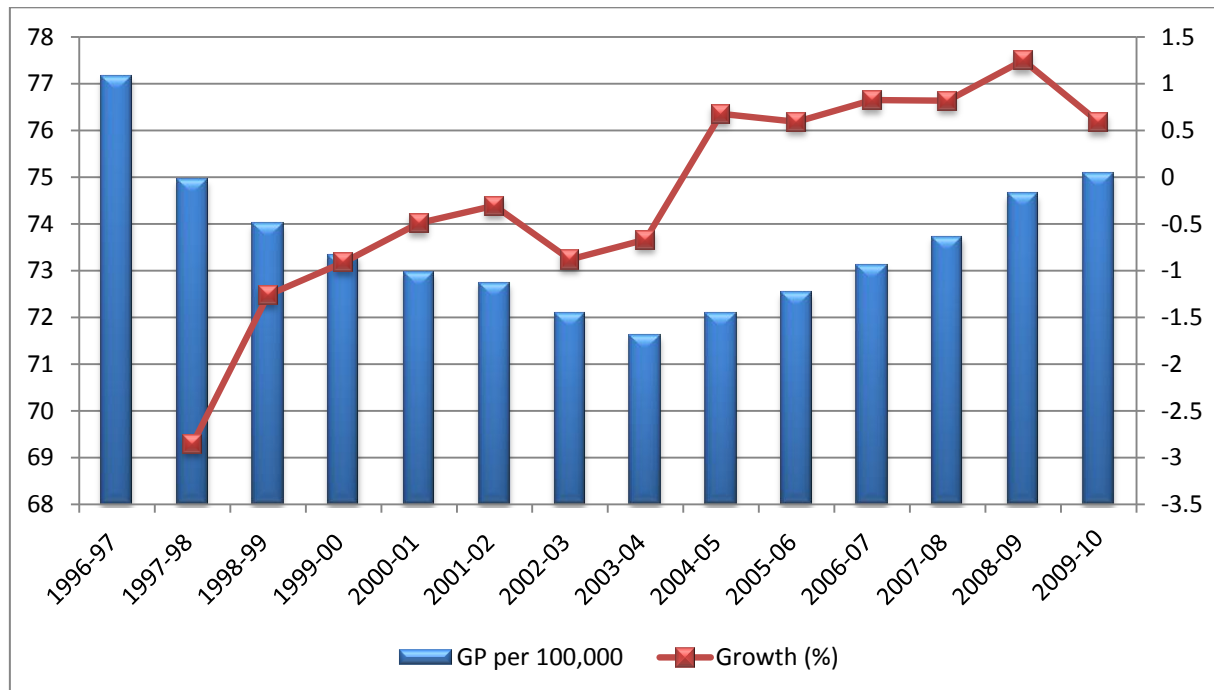


Figure 9: Full-time equivalent GPs per 100,000 persons and growth rate in Australia: 1996-97 to 2009-10

Source: [270]

Similarly, as the information published by the Australian Institute of Health and Welfare shows, the number of available beds in public acute hospitals decreased by an annual average of 3.3%, from 3.1 beds per 1000 population in 1995-96 to 2.6 beds in 2005-06, equating a total reduction of 16.1%. The number of private beds remained stable at approximately 1.2 beds per 1000 population during this period [158: 347]. It is to be noted that definition of bed varies across time and jurisdictions and while the reduced number of beds does not affect demand for EDs, when combined with increased demand for ED services, it can aggravate the problem of overcrowding as evidenced by numerous studies on overcrowding and access block.

9. Discussion and Conclusion

In the event of a health emergency, patients either call for assistance from the ambulance or present themselves by private or public transport to a primary health provider (e.g. general practitioner) or to a hospital ED. Thus there are several key steps in the process which contribute to the decision to seek assistance from an emergency health service. Each of these steps is influenced by a combination of factors including the patient's location, the sense of urgency, the nature of the clinical condition, and access to and availability of service alternatives.

This monograph aims to describe the growth in demand for Emergency Health Services and the factors that appear to have influenced that growth. The data is derived from publicly available sources and presents a collective picture of the current situation. There is always a question in regard to the accuracy of the data. However the reporting arrangements are as accurate as possible and as they are whole population data, the relative impact of data inaccuracies and definitions is likely to be minimal.

The data presented in this preliminary study demonstrate that the growth in demand for Emergency Health Services in Australia exceeds the growth in population, and that the rate of utilisation of Emergency Health Services, and the growth in that utilisation rate differ between the states and territories. Queensland has the second highest ED utilisation rate (after NT) but maintains the lowest growth rate in the country. And while it has the highest ambulance utilisation rate its growth rate is close to the Australian average.

There is no obvious answer for these differences. Variances in age structure, population growth rates, or in the funding and organisational arrangements do not provide an immediate and obvious explanation. For example many believe that the higher utilisation rate for ambulance in Queensland is a result of the introduction of the Community Ambulance Cover in 2003 which provides a perceived "free" ambulance service. However the utilisation rate in Queensland is higher than the ACT and Tasmania where it is also free.

This study demonstrates a growth in demand for Emergency Health Services which has been occurring for many years. The reasons for this growth in demand are multi-factorial both on the individual and population level. Several studies have explored the nature and possible impact of a variety of factors, but it is not known how those factors contribute to the individual's decision to access a particular service options. Therefore the relative impact of those factors on the observed variations in demand levels between states, and the increased level of demand over time is unknown.

Drivers of demand must be identified to enable forecasting of future demand on which to base funding models. Analysis of the literature and previous studies provide a conceptual framework of possible influences. However the research to date is unable to explain the relative contribution of these different influences in different environments. There are a number of possible factors that may influence the growing demand.

Demographic Changes

Australia's population is ageing and improved clinical technology is extending life expectancy. Older people have higher rates of chronic and acute disease which are likely to contribute to the growth in demand for emergency health care as they are known to be higher users of these services [144]. Also, as the pressure on aged care facilities grows those services may refer a greater proportion of patients to EDs.

The demographic distribution of Australia's population is changing with declining populations in small rural towns and rapid growth in cities; particularly the metropolitan cities and their surroundings. People in rural and regional areas are known to have high risk profiles as well as less access to alternative clinical or transport services. Those that live further away from hospitals may prefer the urgent attention of paramedics over transporting individuals to emergency departments or primary health clinics. This, however, requires further detailed investigation.

Changing Health Systems

Changes to the health system will also impact on the growth in demand for emergency health. Increasing specialisation of health care is leading to concentrated specialist services which require transport beyond the immediately available facilities. Attempts to concentrate expertise in particular clinical areas may contribute to the need for further transport and the requirement for emergency health assistance. Policy initiatives such as trauma systems, acute stroke systems, or QEMS seek to provide an organised and structured approach to meeting demand for EHS. Private emergency departments remain a relatively small proportion of the system, accounting for only 8% of all attendances despite a private hospital insurance rate of 45%. Changes to the reimbursement system for emergency services in this sector may alleviate the demand for and pressure on the public emergency health system. Further research is needed to quantify such impact.

Clinical improvements have had a significant impact on the capacity of the Emergency Medical system to intervene in acute illness. Improvements such as pre-hospital defibrillation, thrombolysis, and resuscitation mean that more can be done before and during hospital acute care phases. This leads to a system-wide imperative to provide enhanced Emergency Health Services. Moreover, increased efficiencies and improvements may in turn increase the demand for such services even more. Therefore, opening new EDs, adding more beds and employing more staff may in the short term reduce the pressure on other health services, but in the long run will very likely cause further demand.

More sophisticated and advanced procedures have altered the dynamics of hospital stay. There are an increasing proportion of day-procedures and the average length of stay is decreasing, leading to an increasing pattern of early discharge. These changes may result in a greater number of unexpected readmissions, furthering the requirement for Emergency Health Services.

Also an increased proportion of people with severe chronic illnesses (e.g. cancer) are living longer and making greater claims on the health system as well as emergency health care. At

the same time a lessened reliance on institutional care, particularly for mental health, has resulted in a shift in emphasis to outpatient care, and to a greater reliance on Emergency Health Services to intervene.

Staffing shortages in healthcare during recent decades has limited the availability of alternative clinical services. This combination of genuine shortages with lifestyle changes has led to a decline in relative availability of primary care and domiciliary services, limiting people's capacity to obtain medical assistance and thus inclining them towards the emergency care services.

Increasing accountability across the system, driven by a combination of increased medical indemnity claims as well as by high profile public investigations, is undoubtedly driving a more cautious approach to the provision of health services and the standards of investigation. GPs are less likely to undertake even relatively simple clinical procedures because of the medical insurance costs associated with "procedural" activities. These combined effects may have led to an effective deskilling of GPs.

Reduced access to non-hospital services (e.g. GP services) may result in a transfer of patronage from GPs to emergency departments. Also, delay in access to primary care may result in an increase in condition severity causing a requirement for emergency services. In addition many community and primary health services are currently staffed by overseas trained staff who are unfamiliar with the Australian health care system and lack familiarity with gaining patient access, particularly to private health services. Fewer general practices are providing after-hours services. During after-hours, patients requiring urgent treatment have little choice but to attend an ED.

Epidemiological Changes

Environmental and social changes have impacted on lifestyle behaviours that favour a high energy diet and low physical activity. These changes have contributed to weight gain and subsequent increases in the prevalence of overweight and obesity during recent years. These are risk factors in several increasingly prevalent chronic diseases such as type 2 diabetes, cardio-vascular disease, and osteoarthritic problems.

The population is also living longer with disease. Advances in medical technology and pharmaceuticals used to treat chronic diseases may sustain the life of patients who would otherwise have not survived. Therefore, treatment advances have resulted in a population that is living longer with the morbidity associated with these health conditions. High number of repeat visitors may indicate a large number of people with chronic conditions substituting ED care for primary care.

Socio-economic Change

The macroeconomic environment has a direct association with health expenditure and health system investment. At the microeconomic level, people's capacity to pay for emergency health also has an impact. The high upfront fee for Private ED care and the potential impact of the CAC in Queensland may be relevant. Between 2002-03 and 2003-04

the 18-24 age group experienced the greatest growth in demand for ambulance services and coincided with the introduction of the CAC [271]. It is likely that this group took the greatest advantage of the “free” ambulance use. Although older groups account for the majority of ambulance use, no disproportionate growth in ambulance use occurred at this time as older populations were more likely to subscribe or receive pensioner subsidised ambulance service before the introduction of the CAC in July 2003.

Changing domestic arrangements may result in greater dependence on ambulance services as residents living alone may not have access to private transport coordinated by family members or co-dwellers. As some studies show, the nuclear family, people living alone, and lack of transport seem to be related to the use of ED and ambulance services.

Socioeconomic status may also impact on the patterns of disease experienced by different groups. Increasing income of blue collar workers is associated with an increased intake of high disease-risk foods. In contrast, increased income for white collar workers is associated with decreased consumption of these foods which is associated with a decreased risk of life-style diseases. Both of these changes can directly impact the use of ambulance and hospital EDs.

Expectations and Perceptions

Public perception of the nature of an emergency situation may have changed over time, for example, it may be the case that where private transport was previously acceptable for a condition it is now believed to require ambulance services. The proportion of patients arriving by ambulance has increased, but the increases are largely in the higher acuity categories reflecting the previous evidence of a significant proportion of people who do not call for ambulance assistance when they have significant and serious illness.

There is likely to be heightened demand from a better informed public who are exposed to fictional and actual stories of missed serious illness, and from the capacity of medical miracles to be achieved. More discerning patients who are better informed on health issues, and symptoms to look for, may become increasingly aware and cautious, partly due to success of public health campaigns designed to increase awareness, and partly due to better access to information such as through the internet [146, 193].

Personal attitudes and perceptions may also determine the course of action adopted by patients or relatives. For instance, convenience may be a driving factor for EHS demand particularly in younger cohorts, working groups, and lower acuity patients. Panic stricken calls to the ambulance, a fear of accountability for decision making about relatives, being ‘scared to get it wrong’, liability and potential criticism by significant others can all influence the decision to use the EHS. Further research is required to provide evidence in this area.

Conclusion

Many of the symptoms of system congestion arise from deficiencies in the overall health system. However the growth in demand for EHS is a significant contributor to the current

situation. Therefore, identifying factors affecting demand is of significance in developing demand management policies and strategies. Some initiatives may work better than others. For instance, telephone advisory services or colocated GP clinics have not been shown to reduce demand. On the other hand, programs such as Hospital in the Home and self management of chronic disease seem to reduce the demand without threatening the safety of the patients.

There are new models of care and methods of service provision which may assist with addressing the situation in the future; however in order to achieve success without impact on clinical outcomes, it is important to ensure that these initiatives are directed at the real reasons underlying the growing demand and that these are supported by evidence. The current Emergency Health Services Queensland (EHSQ) study aims to analyse those issues in detail and to attempt, in the Australian environment, to propose solutions that are directed at addressing the real need through alternate but appropriate services.

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